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Editorial Comments

The Port of New York.

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In the February issue of last year, we printed a review of the Port Facilities of New York which had been kindly contributed by the Port's Executive Director, and this month, we are privileged to print a further article by the Chairman of the Port of New York Authority, which deals with its history and recent development. To obtain a complete picture of the port and its activities, these two articles should be studied in conjunction with each other.

A comparison is naturally suggested between New York and London as both are great metropolitan ports with claims to the premier position, London being a great emporium and market for the United Kingdom and the Continent of Europe, and New York occupying a similar position for the Continent of North America. The two cities are also important as the greatest financial and bank-

ing centres of the world.

Other claims to similarity, however, are less apparent. example, the shipping trade of New York is almost entirely distributed along the waterside frontages, over which the Port Authority has no jurisdiction, so that it holds a comparatively minor position in regard to the control of the port, and acts more as an advisory, than an executive body, although it has certain compulsory powers. On the other hand, the shipping trade of the Port of London is about equally divided between the privately-owned river wharves and the several dock systems, complete jurisdiction over the latter, and the navigable waterway, being vested in the Port of London Authority, which also has certain powers of veto over river wharf activities. The two ports have some similarity in regard to barge traffic, as at both, the overside discharge of cargo is a notable feature, with the vested interests of the wharf owners, lighterage companies and watermen, a powerful factor in London, and the railroads a compelling consideration in New York.

The pier and wharf features of the Port of New York are an example of development with little or no co-ordinated planning. A glance at a map of the Port shows that the piers, particularly those of Manhattan on the Hudson River, form a continuation of the streets, a method of construction which no doubt was quite suitable at their period of their origin. To confirm to modern practice, however, it is necessary to provide quay space of sufficient width to accommodate railway tracks, quay cranes, vehicular traffic, mobile cranes and fork-lift trucks, so that nothing short of scrapping large numbers of the existing structures, and reconstructing on entirely different lines, appears to be possible, if ship and cargo congestion and other disadvantages are to be overcome.

As early as 1921, the Port of New York Authority attempted to initiate the first instalment of an overall scheme of port development, but owing apparently to existing agreements, the property of municipalities could not be incorporated, so the proposals were

abandoned.

Pilferage in New York appears to be causing some concern, as will be observed from the short article which appeared recently in the House Journal of the Port of New York Authority and which is reproduced on a following page. In this connection, it is interesting to recall that, at the end of the eighteenth century, one of the principal reasons for the construction of certain enclosed docks in London, apart from the range of the tides and increasing

trade requirements, was the prevalence of plundering and pilferage of riverside wharves and of ships lying alongside or at moorings.

Since the establishment, 30 years ago, of the Port of New York Authority, much has been accomplished, although it has not vet been possible to carry out a co-ordinated and comprehensive development of the waterfronts as a whole. Indeed, owing to the unco-operative attitude of the railroad and shipping companies and also the municipal authorities, it seems probable that any agreement regarding a comprehensive development plan will be long delayed. It is to be noted, however, that allegations concerning certain unsatisfactory aspects of wharf and pier ownership are being voiced in several quarters. These adverse criticisms are likely to have a strong bearing on the situation, and may well prove to be the beginning of a new approach to the subject.

Port Operation Costs in America.

We are also printing in this issue excerpts from an address delivered in Los Angeles by Mr. W. F. Giesen, General Manager of the Maritime Association of the Port of New York, which contains some significant comments on the causes of rising port operational costs in America. The speaker also puts forward suggestions which, in some quarters, will doubtless be regarded as drastic remedies, as his remarks on the quasi-public utility nature of all wharf and pier undertakings in the Port of New York, seem tantamount to suggesting that they should be vested in public ownership on a non-profit making basis.

It appears, therefore, that the present situation in New York is on a parallel with the conditions that prevailed in the Port of London both before the dock construction era and in subsequent years, and which eventually led to the formation of the Port of London Authority with adequate and far-reaching powers.

With regard to American dock labour troubles referred to by Mr. Giesen in his address, this was commented upon in our February, 1951, issue, when we discussed the subject of port facilities and labour in New York. While it cannot be claimed that "decasualisation" has eradicated all evils, nevertheless in most ports where the system has been established, it has brought about a definite improvement in labour conditions generally. It might well accomplish this in New York.

The Importance of Timber for Structural Engineering.

The articles on the use of timber for marine works which are currently appearing in this Journal, have drawn attention to a material which has been largely superceded, in many of its applications, by steel and concrete, and in consequence, has tended to become neglected by engineers in the United Kingdom. In other countries, especially the timber producing countries, techniques which are unfamiliar, or at least unpractised, in the United Kingdom, are to-day applied as a matter of course. This is particularly true in the field of structural engineering.

There are several important ways in which timber differs from the other major structural materials. It is, for instance, the only material which is potentially inexhaustible, for it is the product of trees which can, of course, reproduce themselves over the years. Secondly, it is the only structural material of which there is to-day

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Editorial Comments-continued

no world shortage. Thirdly, it requires in its making no coal or other commodities in short supply, no capital equipment, and the minimum of labour and processing.

These are important facts to a country like Great Britain which must live by exporting, in a highly fabricated form, a large proportion of the raw materials it must import, and in which the only native resources, coal and power, are already insufficient for all needs. There are as yet few signs that the significance of these facts to Britain's economy has been realised, for much productive capacity is still being devoted to home needs when it should be concentrated on the export drive; increased exports of manufactured goods of high value would earn the necessary currency not only to increase imports of timber, but also to contribute materially towards maintaining the overseas balance of trade.

It is to be hoped, therefore, that the current series of articles will serve a useful purpose in describing recent developments in the use of timber for maritime works, as there is no doubt that this traditional and proved material can play a valuable part in helping to overcome present-day problems in this field.

Port Economics.

The series of articles on Port Economics which have appeared each month in this Journal since the beginning of the year, and the last chapter of which appears in this issue, has created wide interest, and we have received many letters from different parts of the world asking whether the complete series will subsequently be available in book form.

As we stated in our issue for December last, the present series, written by Mr. A. H. J. Bown, O.B.E., F.C.I.S., M.Inst.T., General Manager and Clerk to the River Wear Commissioners, is complementary to the articles on Port Operation and Administration contributed by the same author in collaboration with Lt.-Col. C. A. Dove, M.B.E., M.Inst.T. Both subjects were specially written for this Journal at the request of the Institute of Transport for the use of students preparing for the Institute's examinations.

We are pleased to inform our readers that we hope to publish the present series at an early date. Further details will be announced as soon as final arrangements have been made.

Topical Notes

Restoration of Eritrean Ports.

One of the first tasks to be undertaken in Eritrea, following the federation of the former Italian colony with Ethiopia under the sovereignty of the Emperor Haile Selassie, is to rehabilitate the Ports of Massawa and Assab, which are Eritrea's only outlets to the sea. The facilities of both ports must also be improved and enlarged.

Demolitions were carried out at the former Italian naval base of Massawa immediately after the surrender of Italy during the recent war. Installations there, regarded as reparations by the British authorities, included a floating dock, cranes, railway lines, electrical generating plant, barrack buildings and workshops. The floating dock was sold to a commercial firm and other material was sold by tender.

Demolitions did not, however, extend to Massawa civil port, although American installations built during the war under lendlease arrangements, mostly in the area of Massawa, were broken up or completely dismantled and sold by the British administration under agreement with the United States Government. The chief officials of the new Eritrea all speak highly of British administration during the post-war years.

With the union of Eritrea and Ethiopia, Italy's former colony is now expected to reap many of the benefits of America's technical and financial resources. Preliminary conferences and studies of Eritrea's immediate needs are already in hand between American officials and the Federal authorities.

Proposed New Port for Yugoslavia.

It is reported that work is to begin in the near future on the greatest engineering project undertaken in Yusoslavia since the war—a 310 miles long railway to link Belgrade with Bar, on the Adriatic coast.

This old project, which will transform a small Adriatic holiday resort into the second largest port in Yugoslavia, is expected to have far-reaching economic and social consequences for the backward eastern half of the country.

As far back as 1908, foreign experts who visited the Bay of Bar, in the south-east corner of what is now Yugoslavia, expressed the opinion that there was no more favourable spot on the entire Adriatic coast for building an international seaport.

The new port, which will be the nearest point in Yugoslavia to overseas markets, will cost over 4,000,000 dollars (about £1,334,000) to build, and is scheduled to handle about 1,500,000 tons of commerce a year.

Already 120 yards of breakwater have been constructed and if the Yugoslav National Assembly accepts the proposal that large scale work should start next year, the Port of Bar should be able to handle ships of all sizes and tonnages by 1954.

The construction of the Belgrade-to-Bar railway, which is expected to take up to six years to complete, will be a more

difficult undertaking. Tunnels will have to be driven through the rugged mountainous terrain of South Serbia and Monteregro and will cover about 50 miles, or 16 per cent. of the route, with the longest covering about 5 miles.

Yugoslav engineers have already marked out the tracks from Belgrade to Valjevo and Fromkolasin to Bar. The rest should be completed by the end of the year so that large-scale work can begin next spring.

New Port at Tangku.

According to a report published in the Chinese Communist press, the first phase of construction of the new harbour of Tangku at the mouth of the Hai-ho, is almost complete, and vessels of up to 10,000 tons will be able to use it next month. The harbour, built on the north bank of the Hai River, will be able to accommodate four 10,000 ton vessels and five smaller ships of up to 3,000 tons. At present, only ships of up to 3,000 tons can make the thirty-mile journey up river to Tientsin, and ocean-going vessels have to discharge cargo into lighters at the river's mouth.

It is reported that future developments include dams to control flooding of the hinterland and a new artificial waterway direct to Tientsin. Tientsin itself was opened as a Port in 1860 and the Kuomintang Government selected the site for this new harbour many years ago, although no progress was made until the Japanese took over during the war. After the war, work was resumed by the Kuomintang and later by the Communist authorities.

A brief reference to the new Tangku harbour was previously made in our issue of June 1946.

Dock Labour Board for Calcutta.

It was recently announced that a Dock Labour Board for the Port of Calcutta has been constituted by the Government of India to administer the Calcutta Dock Workers' (Regulation of Employment) Scheme, 1951. The Board will number 12 members and the Central Government, the dock workers, and the stevedoring and shipping companies will all have equal representation. The dock workers' representatives will include two nominees of the Dock Mazdoor Union and one each of the Calcutta Dockers' Union and the National Union of Dock Labour.

Proposed Western European Academy of Sciences.

It was recently announced from The Hague that a Dutch proposal for the establishment of a Western European Academy of Sciences has been submitted to Great Britain, France, Belgium and Luxembourg and is now under consideration by the Governments concerned. The proposal dates back to the work of the former Netherlands Minister of Education, Arts and Sciences, Professor F. J. T. Rutten, who was its originator.

As its main task, the Academy would act as a clearing house for scientific ideas, with a view to enabling the participating countries to obtain a complete picture of modern scientific developments. It would also organise international scientific research of any kind beyond the financial and material resources of single nations.

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The Port of New York

Development of a Leading World Port

By HOWARD S. CULLMAN Chairman of the Port of New York Authority.

HE rise of the Port of New York to its prominent place among the ports of the world, began in the earliest colonial days. Establishment of New Amsterdam by the Dutch was directly due to its harbour, unsurpassed by any other visited by the early explorers, and from its initial beginnings, the people of the colony depended for their very existence upon its shipping trade.

The pattern of this trade was the reverse of what it is to-day. Under the Dutch and subsequently while the port was a British Crown Colony, "necessaries" — manufactured goods — had to be brought in from Europe. To balance these imports, the colonial merchants shipped the agricultural, mineral and animal products of the colony—wheat, beans, peas, oats, Indian corn, furs and skins, butter, cheese, timber, potash and the like. As a British colony, most of New York's overseas commerce was with Britain and the West Indies, but in spite of prohibitive laws, some business was carried on with other European countries.

The port was a busy place in the eighteenth century. Along its East River waterfront was a forest of masts of ships berthed at the wharves. Such familiar American names of to-day as Roosevelt, Livingston, Schuyler, Alsop, Brevoort, Murray and Schermerhorn were well known in the counting houses, where clerks, perched on high stools, drove their quills over ledgers and voices droned of cargoes, manifests, packets and the ports of Europe and the Spanish Main.

In 1784 the infant republic of the United States made an auspicious start as a trading nation when the American-built ship Empress of China sailed from the Port of New York for Canton, China, the first United States vessel to venture into Asiatic waters. Her profitable voyage started a rush of vessels bound for China. New York's berthing facilities soon became crowded and a great period of port and trade expansion began. More piers were built along the East River, but the waterfront had already begun to spread out to include the Hudson River shore of Manhattan, which had been extended 200-ft. by filling with large trunks of trees and an enormous weight of stones. And the New Jersey side of the harbour was being built up. Jealousy between the two integral parts of the port was apparent even then, however, when New York, which claimed the land of the Hudson River bed

wharves there.

In 1807 the Embargo Act, passed in retaliation against French and British trade restrictions and prohibiting vessels from leaving United States ports for foreign destinations, put a quietus on the port's expansion

as far as the New Jersey shore, attempted

to prevent its neighbour state from building

and 500 ships swung idly at their moorings. Ending of the Embargo in 1800 and subsequent privateering operations during the war of 1812 turned stagnation into a boom. Conclusion of the war found the port ready for an even greater upswing, the greatest expansion of trade in its history.

It was heralded by the first departure of a regularly scheduled trans-Atlantic packet ship, the James Monroe of the famous Black Ball Line, for Liverpool. By 1828 there were 28 scheduled packets on the trans-Atlantic run. A remedy for the preponderance of imports over exports was found in the cotton trade. Then, as to-day, the Port of New York had the most regularly scheduled and frequent trans-Atlantic services and many southern planters preferred to ship their cargo via New York to Europe.

Two events in those early years of the century spelled continued prosperity for the port. Opening of the Erie Canal in 1825 provided a pathway to and from the fertile and undeveloped territory of the Middle West. And the first practical operation of steamboats, though it doomed the sailing vessel, meant that the Port of New York, strategically located and well equipped to handle the faster, bigger ships, would benefit in the era of steam.

Meanwhile, the famous clipper ships, with their astounding speed, dominated the rich China tea trade and brought additional prosperity to the port. New York also led in the fabulous California gold rush trade which began in 1849. It was the starting point for 73% of the clipper ships and its nearest rival had only 26% of the departures. But steam would have its way; in England a man named Samuel Cunard had started a trans-Atlantic steam packet line, and in 1846 he transferred its American terminal from Boston to the bigger, faster-growing Port of New York, building wharves for his steamers on the Jersey City waterfront in New Jersey. More names, now familiar to modern-day transportation, began to appear in the daily shipping news — Anchor, North German Lloyd, Compagnie Generale Transatlantique.

In the 1870's the New York-New Jersev Port was handling 50% of the country's leading exports, except for cotton. Services to the Mediterranean, the Caribbean, the Pacific Coast and to United States Gulf of Mexico ports were being established. Competition for trans-Atlantic speed records was very keen. The Blue Riband was held at various times by the Inman, White Star and Guion lines. Some of the speed records compare very well with those of modern superliners. In 1873 the Guion liner Oregon crossed in the then record-breaking time of six days, ten hours, ten minutes.

The two decades between 1880 and 1900 were marked by a growing realisation of the

need for channel improvements. In 1885 Congress appropriated \$750,000 for such betterments, made necessary by the increasing size of steamships. The scope of pier and terminal facilities had increased greatly, especially along the Brooklyn waterfront and on the New Jersey shore.

During the first ten years of the 20th century it became apparent that the need for development and improvement of the Port of New York had reached a stage where something must be done soon if the port were to maintain its supremacy. The best minds in port and shipping affairs were at work on the problem. Several proposals were advanced and although none were carried out they served to stimulate study and discussion by port and shipping officials.

The decade from 1910 to 1920 was marked by a lack of unity between the port interests of New York and New Jersey. The differences were of long standing, going as far back as colonial days, but the famous New York Harbour case before the Inter-state Commerce Commission, in which the participating New Jersey interests sought to obtain certain advantages over New York in railroad rates from points west of the port, brought the contention to a peak.

It had one excellent result, however. During the long period when the case was pending it became apparent to many of those involved that both New Jersey and New York could gain more through co-operation and that the welfare of both was bound to the welfare of the entire port area. Out of this realisation came developments that finally led to the creation of The Port of New York Authority.

In order to understand clearly the advantages of unity between the New York and New Jersey portions of the Port of New York, a knowledge of the geography of the port area is useful.

Geography of Port Led to Creation of Port Authority.

Outline maps of the land and water areas in the New York-New Jersey Port District—roughly described by a 25-mile radius from the Statute of Liberty—drawn 31 years ago and to-day would be practically alike. It is now, as it was then, made up of many deep waterways cutting off Long Island, Manhattan and Staten Island from the mainland and making peninsulas out of other land masses. Its area is large, 1,500 square miles; it has to be, to accommodate the traffic of one of the greatest ports in the world.

No other port has a geographical nature exactly comparable to that of the Port of New York. Part of it is in New Jersey, and part in New York, and before 1921, the two states shared jurisdiction over the harbour. Neither one, alone, could co-ordinate the un-

The Port of New York_continued



Looking northward from Upper New York Bay toward the Hudson River waterfronts of both New Jersey and New York.

equalled facilities of the port; in effect, the harbour was a single unit, an expanse of water having various bays and waterways all of them reached from a single harbour entrance, but it served two masters.

In 1917 the two states reached the wise decision to unite as equal partners in furthering the New York-New Jersey Port's development, when the New York-New Jersey Port and Harbour Development Commission was created. It made detailed and voluminous studies and developed a programme for the future. This programme led to the signing of what is known as the Compact of 1921 between the two states. In turn, this treaty resulted in the creation of The Port of New York Authority to carry on permanently the work of port development for both states.

The Compact, signed on April 30th, 1921, declared that a "better co-ordination of the terminal, transportation and other facilities of commerce in the port area would result in great economies, benefiting the nation as well as the two states." "Such a result," it added, "can best be accomplished through the co-operation of the two states by and through a joint or common agency." The Compact, also defined the limits of the Port District; its first responsibility was to prepare a comprehensive plan for the development of the port region, and this was submitted and approved in 1922.

With the Compact and comprehensive plan as guides, amended from time to time to meet changing conditions, the Port Authority embarked upon the task of carrying out the objectives entrusted to it.

Early Port Authority Activities.

The comprehensive plan envisioned the development of the port for all types of transport, including ocean-going vessels, trucks, buses and aircraft. It was evolved at a time when railroads were still the principal form of land transportation. The early years were directed towards a unification of the railroad terminal system of the Port District.

One important step was achieved in 1932 by the opening of the Union Railroad Freight Terminal in the Port Authority Building in Manhattan. About 250,000 square feet of street level and basement space were leased to eight railroads as a joint station tor receiving and despatching mixed merchandise less-carload freight. Shippers' trucks can receive or deliver freight for any railroad at this terminal, greatly reducing the peddling of freight consignments to individual terminals and thereby saving truck mileage through congested streets. The terminal has handled as high as 400,000 tons of less-carload freight and express packages in a year.

When the Port Authority was established, there were no fixed vehicular crossings over or under the waterways between New York and New Jersey, although work had been started on the Holland Tunnel under the Hudson River. The distance of approximately 50 miles from one extremity of the Port District to another involves crossing not one but several bodies of water, all of them integral parts of the New Jersey-New York Harbour. In making these crossings, trucks, buses and autos had to use ferries.

To-day the ferry boat is on its way to becoming a curiosity. Thanks to modern invention, engineering and administrative progress, the time required to get from one part of this widespread port area to another has been sharply reduced. To those who have witnessed the development of transit facilities within the past three decades, the change may not seem startling. But to some contemporary Rip Van Winkle who had slumbered many years to wake up to-day it would be bewildering and incredible.

The Port of New York Authority is an agency of the States of New York and New Jersey, ideally equipped to handle that part of the vehicular transportation problem that crosses state lines. Its Holland and Lincoln Tunnels under the Hudson River between the two states carry an ever-increasing stream of motor traffic, as do the wide roadways of the George Washington Bridge, suspended by means of miles of wires of steel, arching above the river. From New Jersey to Staten Island three other huge Port Authority bridges — Bayonne, Goethals and Outerbridge Crossing—link these two areas. Over 67 million vehicles took advantage of the six inter-state facilities during 1951.

Municipal and state agencies have also contributed to the connecting of the various port areas by the construction of inter-state bridges, tunnels and modern superhighways. These express arterial highways gird the Port District and help to keep traffic flowing unchecked over the crossings.

The recently opened New Jersey Turnpike

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The Brooklyn and Manhattan Bridges cast their shadows over the East River waterfront scene of the Port of New York's first harbour development.

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The Port of New York-continued

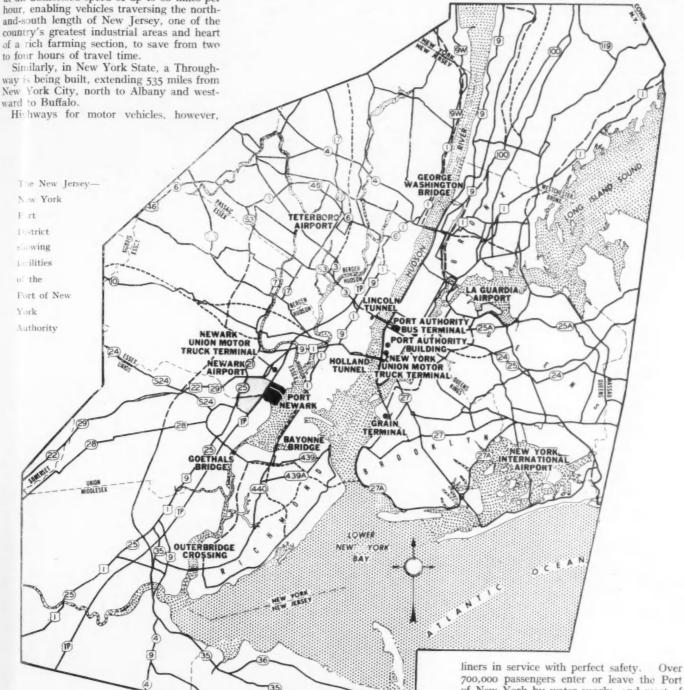
stretches 118 miles from the New Jersey-Delaware border at Deepwater, N.J., to direct connections with the Lincoln Tunnel and George Washington Bridge and provides an uninterrupted route for trucks as well as autos. The Turnpike is designed for safety at an authorised speed of up to 60 miles per hour, enabling vehicles traversing the northand-south length of New Jersey, one of the country's greatest industrial areas and heart of a rich farming section, to save from two

Similarly, in New York State, a Throughway is being built, extending 535 miles from New York City, north to Albany and westcreasing volume of both cargo and passengers safely and efficiently.

Improvements to Port's Approaches.

To-day there are over 150 miles of channel in the Port District having an authorised

Channel, the approach from the Atlantic outside the harbour entrance into Upper New York Bay, and its continuation, the Hudson River Channel, leading up to the big trans-Atlantic piers in Manhattan and New Jersey, are 45-ft. deep, enough to float the biggest



are not the only improvements made in the approaches to the New York-New Jersey Port during the past 30 years. Harbour channels, railroads and the chartered lanes of the air have undergone continued expansion and improvement for carrying an indepth of over 20-ft. Of this total, 88 miles is over 30-ft. in depth, an increase of more than 50 miles over 1921, when there were only 36 miles of such channels. These depths of over 30-ft. are ample to accommodate all cargo carriers using the port. Ambrose

700,000 passengers enter or leave the Port of New York by water yearly, and most of them are on vessels using the two latter waterways

All of the port's channels that lead from the sea up to the piers in every part of the far-flung Port District are maintained with extreme care for safe navigation. Part of this maintenance programme is the deepening by

The Port of New York_continued

removal of silt and rock from the bottom.

The Port of New York has kept abreast of the needs for clear and deep channels. Two dredges of the U.S. Army Corps of Engineers ply the waters of the narbour continually with long hollow steel tubes from their holds lowered to the bottom. As the dredges cruise slowly up and down the channels the silt is sucked up by powerful pumps.

Newer of the two dredges, the Essayons, is the world's largest, 525-tt. long, with a capacity of over 8,000 cubic yards of dredged material. Her name, the motto of the Corps of Engineers, meaning "We try," is modest; she succeeds handsomely in her part in keeping New York Harbour channels in perfect navigable condition.

Like the dredges, a self-propelled drift collector named the *Driftmaster*, is operated by the U.S. Army Corps of Engineers. Square-built like a barge, with a tripod mast and boom and a large opening in her bow, this craft works eight hours a day, five days a week, getting into the most remote corners of the harbour as well as it broader reaches. The flotsam in her path is rarely salvageable. This debris is burned in two incinerator barges.

Many improvements have been made in the great fleet of floating harbour equipment required to move the immense volume of ocean freight which moves daily through the New Jersey-New York Port. Altogether there are nearly 2,500 pieces of railroad floating equipment to accomplish the mammoth The motive power of this armada is the tugboat. The efficiency of these harbour craft has been increased significantly by the use of two-way radiotelephones so that despatchers can keep in touch with them at all times. Diesel-powered tugs are gradually replacing the railroads' steam tugs, and steel barges, carfloats and scows are being constructed in place of wooden craft.

Dieselisation and electrification by the trunk line railroads serving the Port have vastly improved these vital services in the 31 years since 1921. Safer and more economical operation, faster transit for both passengers and freight, and increased comfort of passenger travel have resulted.

Development of Marine Terminal Facilities.

The City of New York owns about 50% of the deep-sea piers, the railroad companies about 5% and private dock companies and individual steamship lines about 35% of the waterfront facilities at New York Harbour. The Port Authority administers only the remaining 10%.

At the present time the bi-state agency administers only one marine terminal on the New York side of the port, the Port Authority Grain Terminal, located at the foot of Columbia Street in the Gowanus Bay section of the Brooklyn waterfront. Built by the State of New York as a part of the New York State Barge Canal System, it was transferred by the state to the Port Authority in May, 1944.

The terminal includes a grain elevator, a new deep-sea grain pier and shipping gallery constructed by the Port Authority, the Columbia Street Pier and a public open storage area of five acres. The latter pier accommodates four oceangoing vessels simultaneously along its 1,250-1t. length. The pier is used by two steamship lines under a preferential permit system which enables the facility to be used most intensively. This arrangement allows vessels, in addition to those of the two permitted steamship lines berthing there, to use the pier on special assignment by the Port Authority. For the last two years this single pier has docked an average of over 90 vessels a year for about 385 shipdays.

Equipped with a storage capacity of 1,800,000 bushels, the Grain Elevator at the terminal is the most modern facility in New York Harbour for the storage of grain. Wide conveyor belts carry the grain from the elevator to spouts which funnel it directly into ships docked alongside the gallery. During 1951 over 9,570,000 bushels were handled at the elevator.

In 1948, at the request of the City of New York, the Port Authority undertook a comprehensive study of and made a proposal for rehabilitation, modernisation and reconstruction of the municipal piers of New York. This \$114.000.000 proposed improvement plan was designed with the entire port picture in mind. However, the City of New York declined the Port Authority offer in favour of a less comprehensive programme advanced by its own Department of Marine and Aviation.

Port Newark

Most extensive of the Port Authority's marine terminal developments is being

accomplished at Port Newark, New Jersey, an integral part of the Port of New York. Port Newark came under Port Authority management in March, 1948, under the provisions of a 50-year lease with the City of Newark. Under the terms of this lease the Authority was required to rehabilitate, develop and operate Newark's port. The bistate agency has actively sought accomplishment of these requirements. It has completed many of the projects called for in its lease, but it will not permit its programme to become static.

Port Newark is about 3½ miles from the centre of Newark, and nine miles by water from the Narrows entrance to New York Harbour via the Kill van Kull. This installation is comprised of 612 acres divided into two sections by a channel 7,000-ft. long. The channel, 35-ft. in depth, provides steamship berths for 21 ships along its 11,576 lineal feet of wharves.

A review of recently completed projects at Port Newark, a port within a port, reveals why this facility increased its total cargo handled from 811,780 tons in 1947 to 1,842,733 tons in 1951—a 125% increase in four years. Over \$11,000,000 in capital improvements have been completed or are under way, and \$12,000,000 more has been earmarked for projects to be completed by 1954. Some of the finished projects include widespread rehabilitation of miles of railroad track, installation of a new fender system to protect wharves, dredging of Port Newark channel to provide a uniform depth of 35-ft. re-building of old and construction of new wharves, the repair of existing cargo sheds,

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Nine ships berthed simultaneously at five piers $\operatorname{testify}$ to the activity on Manhattan's Hudson River shore. Note the elevated vehicular expressway which extends along the entire length of Manhattan's West Side piers.

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The Port of New York_continued



Artist's drawing showing new and future construction at Port Newark

warehouses and industrial buildings. Soon to be opened is a new single-storey warehouse, fully heated and especially designed for economical handling and distribution of canned goods.

In 1950 two cargo terminal buildings were completed and two more are in the process of being built. The two completed structures have been in constant use and have proven efficient by speeding up the handling of ship cargoes.

New Marine Terminal.

In March, 1952, the Port Authority and the Waterman Steamship Company, with world-wide service, entered into an agreement calling for the construction of a three-berth modern marine terminal, including wharves and terminal buildings, at Port Newark. The new \$6,000,000 terminal, to be completed in the spring of 1954, is expected to more than double the general cargo now moving through the Port Authority facility and bring the total to over a million tons yearly.

Each of the three berths will be 550-ft. long, with adjacent aprons 50-ft. wide between the cargo terminal buildings and shipside. As at all Port Newark wharves, the wide aprons will afford adequate room for the efficient use of mechanised handling equipment during loading and unloading operations. Dual railroad tracks extending the full length of the wharf will enable heavy items to be lifted by ship's tackle directly from rail car to a freighter's hold. Units whose weight exceeds a vessel's hoisting capacity can be transferred from rail cars to the deck of a floating derrick and thence to the loading ship. There will be additional railroad tracks at the rear of two of the three new cargo terminal buildings, alongside a canopied loading platform 16-ft. wide. This platform, at tailgate level, will also accommodate truck traffic.

Similar to other Port Authorityconstructed buildings at Port Newark, the new structures will have roofs and sidings of heavy corrugated fire-resistant metal protected by special treatment and coatings to extend its life beyond that of ordinary galvanised metal. Smooth floors, flush with the exterior apron, will have an allowable floor load of 600 lbs. per square foot. The buildings will be of one-storey construction with a total of 270,000 square feet of cargo space, or 90,000 square feet for each berth. A minimum piling height of 20-ft. will assure ample space for tiering cargo throughout the termi-An extensive sprinkler system will provide complete fire protection.

Still another new facility will soon be added to Port Newark in the formation of a fumigation plant. Two fumigation tanks will occupy 3,200 square feet of a 14,400 sq. ft. capacity building, while the remaining space will be used for storage. Cotton from India, Egypt, Brazil, Peru and other South American countries, as well as broom corn, burlap bagging, tobacco, sisal, chestnuts and bamboo are among the commodities requiring fumigation upon arrival at Port Newark.

These commitments will keep the Port Authority busy until 1954, but with more Port Newark waterfront and upland area remaining to be developed, the bi-state agency will carefully examine any new projects suggested for the New Jersev seaport. It will select those best suited to a wellrounded development, especially those steamship terminals, bulk terminals and special installations lacking in other parts of the New York-New Jersey Port.

Hoboken-Port Authority Piers.

On October 1, 1952, the United States Maritime Administration leased the government-owned water front properties at Hoboken, New Jersey, to the City of Hoboken for 50 years. Simultaneously, the City subleased the valuable water front area to The Port of New York Authority for a similar period. The bi-state agency, under the terms of the lease, plans to proceed immediately with an agreed plan of building and reconstruction.

Under the Port Authority's plan, two new piers will be built and three existing piers, their headhouses and other upland facilities will be rehabilitated. Eventually, the three piers now standing on the site will be demolished to make room for the new development. One of the two new piers will be completed in four years and the other in eight years. Each will cost \$7,500,000. third new pier may be built at the Port Authority's option, in which case the Authority's lease will be extended for an

additional 50 years.

First to be built will be Pier C, a singledeck, two-berth general cargo pier 660-ft. long by 345-ft. wide. Dual railroad tracks will extend 500-ft. out from shore within the pier, and there will be an additional track on one of the pier's aprons. Equally good facilities will be provided for the delivery of truck-borne freight, as a continuous-loop traffic lane will enable trucks to make their deliveries and then move off the pier without turning around. As at the Port Authoritybuilt facilities at Port Newark, these new piers will have 90,000 square feet of shedded area per vessel berth.

Pier B, second of the planned piers, will be 10-ft. shorter than Pier C, and with the exception of a few other minor differences

will be identical to it.

The Hoboken-Port Authority Piers are strategically located between the Port Authority's Lincoln and Holland Tunnels. giving trunks travelling to and from the New York side of the port easy access to them. Railroad deliveries are also simplified since many of the railroads serving the port terminate in nearby New Jersey localities and it is an easy matter for their cars to be switched directly to the Hoboken piers. Proximity to other forms of transportation aids greatly in making Hoboken steamship terminal one of the most desirable in the entire Port of New York.

Survey of Other Marine Terminal Locations on New Jersey-New York Waterfront.

A Port Authority proposal for the construction of a new marine terminal in Jersey City, N.J., which was made in 1949, was rejected

by the municipality.

Various other port improvements have been undertaken by private enterprise in various sections of the port. Included in the new waterfront facilities are a four-berth terminal at Erie Basin in Brooklyn, an ultramodern fresh-handling terminal at Weehawken, N.J., and the modernisation of other piers and terminals on the Brooklyn and Manhattan waterfronts. To be able to handle the major portion of American foreign trade, the Port of New York will build and re-build terminal facilities as required. The Port Authority in particular is constantly examining the waterfront facilities and it

The Port of New York_continued

does not intend, therefore, to let the port rest upon its accomplishments.

Major Airports for the Metropolitan Area.

The four major airports of the New Jersey-New York Port District—New York International and La Guardia in New York, and Newark and Teterboro airports in New Jersey—are being operated by the Port Authority under a long-range programme designed to improve and expand these airport facilities to meet effectively the growing air transportation needs of the Port District.

More than 280,000 planes moved in and out of these airports in 1951, carrying over six million passengers and a large and continually expanding volume of air cargo to and from all parts of the United States and every corner of the globe.

The four airports are being developed as a sound, well-integrated regional system, with the bulk of the overseas traffic being handled at the giant New York International Airport, which handled 481,000 overseas air passengers in 1951, and the domestic services by Newark and La Guardia, while Teterboro is used for certain specialised types of air cargo traffic and by private, executive and corporate aircraft.

The Port Authority's schedule of airport development, governed by an awareness of the air traffic potential and related economic realities, has been: (1) to construct air terminal facilities to meet immediate demands for airport services as expressed by a growing air transportation industry, and (2) to plan ahead for the provision of enlarged permanent facilities which it believes the future growth of air traffic will require.

Terminal Facilities for Motor Transport.

To-day a major form of passenger transportation, motor buses carry a large share of this traffic entering and leaving the port, including both long-haul and commuter services. Formerly, terminals for these bus lines were scattered throughout mid-town Manhattan and buses entering and leaving the city added greatly to the congestion of streets in the heart of the metropolis.

In December, 1950, the opening of the Port Authority Bus Terminal, located in midtown Manhattan only about one block from Times Square, not only eased this congestion but facilitated and speeded bus travel to and from the city. The new terminal is connected directly with the Lincoln Tunnel by overhead ramps so that incoming and outgoing buses from New Jersey do not use Manhattan streets. Most of the individual bus terminals have been eliminated by the new facility and to-day more than 5,000 buses carrying 125,000 passengers use the Port Authority terminal on an average weekday, including long-haul lines serving every part of the United States and short-haul carriers providing service between New Jersev and New York for the great host of people who work in New York City and live in New Tersey.

Nor has motor freight transportation been neglected in the Port Authority's programme of port development. Two big terminals, the New York Union Motor Truck Terminal in Manhattan, and the Newark Union Motor Truck Terminal in Newark, N.J., have been built. The former was opened in 1949, but is closed temporarily to develop a method of platform management. The Newark terminal is presently under lease to the United States Air Force and will be put into trucking operation when military need for its facilities is over.

These terminals were designed to reduce street congestion, to provide modern facilities and equipment for the clearing of common carrier mixed merchandise truck freight and to reduce handling costs. They are consolidating terminals at which this type of merchandise can be received and sorted on a single platform for interchange between long-haul over-the-road units and local city pickup and delivery trucks.

Trade of the Port.

The volume of the New York-New Jersey Port's business demonstrates the satisfaction of the shippers who use the port. New York Harbour does not continue to hold its place as the crossroads of the world's transportation through sentiment or affection, inherent rights, nor any indifference on the part of traffic managers or others who shrewdly calculate the costs of transporting goods and material. On the contrary, the Port continues to be the leading overseas gateway for the United States because year in and year out, in good times and in bad times, it offers a range of transport service and facilities that cannot be duplicated on any American coast.

That is why the Port of New York handled 32,481,829 long tons of waterborne foreign cargo in 1951, compared to 24,949,374 long tons through Philadelphia and 10,488,841 long tons through New Orleans. Other trade data for 1951 reveals even more significantly the importance of New York as a handler of America's oceanborne foreign trade. Last year the New York-New Jersey Port's share represented 47% of the total dollar volume of the United States import-export freight.

First and foremost, the bi-state port is a general cargo port, equipped for and experienced in the handling of merchandise freight. This is in sharp contrast to a number of other American ports which are specialists, with much of their trade made up of one, two or three major commodities. They are geared mainly for coal, for oil, for fertilisers, for grains, cotton or ores.

Not only is the port ready to handle any commodity, but it can get the cargo to destination faster than if it were shipped through other ports. This is made possible by the fact that the great bulk of the port's ocean trade moves directly to and from foreign ports with no intermediate stop-overs at other U.S. ports. The vast majority of inbound cargo ships discharge first at New York Harbour, then proceed to other U.S. ports, returning to New York for completion of outbound loading. This is of primary consideration for the shipper to whom time is money.

Further, from the standpoint of versatility and flexibility of services, the Port of New York offers an unsurpassed range of steam-ship services. Whether a shipment is destined for London, Barranquilla, Oslo, Cape Town, Yokohama, Bombay or any other major seaport, the New York-New Jersey Port has scheduled steamship sailings there. An average of 10,000 ships a year, engaged in foreign, inter-coastal or coastwise services, come regularly into the harbour to discharge and pick up cargo and passengers.

Know-how" is that essential ability needed to make the many facilities and steamship lines perform with an efficient orderliness at the vast port. It is the "knowhow " of the broad ranks of men who service shipments through the New Jersey-New York Port which time and again has aided the port to retain its position as the premier export-import gateway of the United States. Its banking facilities finance 75% of the nation's foreign commerce. Over 500 foreign freight forwarders and customs house brokers make the detailed arrangements for an equally large portion of the country's international trade. Most of the marine insurance underwriters are found in New York, and are among the specialists who are con inually available and eager for the opportunity to serve shippers here and overseas.

Trade Promotion at the New York-New Jersey Port.

A team of transportation specialists employed by The Port of New York Authority keeps in touch with hundreds of exporters and importers to help to solve their shipping problems. Besides its Trade Promotion Division headquarters at New York, the Port Authority maintains Trade Promotion Offices at Chicago, Cleveland, Washington, D.C., and Rio de Janeiro, Brazil, where they can give first-hand assistance and information to the shippers located in the surrounding areas. The trade promotion managers spend most of their time in the field discussing practical problems confronting the shipper whose goods are going overseas. Through their intimate knowledge of port operations they frequently can effect savings in transportation costs for these inland shippers, some of whom may be located a thousand miles or more from the port.

Although the basis of the New York-New Jersey Port's promotion programme is personal solicitation, everybody cannot be reached in this manner. The Port Authority, therefore, distributes thousands of traffic advice bulletins describing revised transportation rates and services, special reprints of port articles of interest to shippers, maps showing the location of rail and steamship terminals in the harbour, highway maps, bulletins on embargoes and the lifting of embargoes, and scores of other items helpful to shippers.

Though not as tangible as the steel, concrete and bricks of the new marine terminals, the work of the Port Authority's trade representatives in assisting shippers in the economical and efficient use of the Port of New York is an important factor in the continued leadership of the crossroads of world trade.

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Communication Difficulties of South Wales Ports

A Case for Co-ordination of Transport*

By J. DAVISON

Trade between the Midlands and the South Wales Ports has long been one of the main interests of all concerned in the prosperity of this area. Every effort has been made to secure a share of the traffic with much expenditure in time and money, but the results have been so meagre and disappointing in the main, that it may be well to review the position and examine realistically those factors which have been found to be the principal causes militating against progress and success.

The main imports into the South Wales Ports are in bulk, being carried in tramp tonnage and utilised in local industries. There are a few commodities such as aluminium, copper, manganese ore etc., which are carried in bulk by liners, but these cargoes are the main reasons for the vessels calling at our ports. Only on reasons are cargoes discharged destined for the Midlands or beyond.

The regular discharging ports for liner traffic on the west coast are Avonmouth, Liverpool and Manchester; each of these ports can command enough cargo for its own industries or distributive traces to warrant regular calls by liners, and consequently imports for the Midlands can be dealt with through any of these ports with the certainty of early and regular shipment, the deciding factor being the cost of transit from the port to destination.

It is to exports that our main efforts have been directed and where our hopes are centred, but unfortunately not yet realised. Why have we not met with success in greater measure? Let us examine in some detail the factors to be overcome.

Communications.

Are our roads and railways adequate to our needs? It is, I think, generally accepted by all, from the Minister of Transport to the smallest user of road transport, that a new trunk road from the Midlands to South Wales is so necessary as to command a high priority, and is essential to any substantial increase in traffic. A greater proportion of cargo tends to come by road, and we must continually press for road access to this area to be commensurate with modern needs.

The railways are static in the sense that the routes available are not likely to be altered, and whatever criticism may be made from time to time, could undoubtedly handle a much greater volume of traffic without difficulty.

There seems to be an idea prevalent in some quarters, that once first-class road facilities have been provided, an endless stream of cargo will automatically travel to the South Wales Ports. Nothing would be further from the truth. Without minimising in any degree the tremendous advantage improved communications would give, there are other factors, and factors more difficult to overcome, still to be met.

Transport Charges.

In our investigations we have received no evidence that our ports are at any disadvantage in respect of road haulage charges in comparison with other ports, but we are at a serious disadvantage when traffic moves by rail.

We are faced with innumerable special rates which have come into being over a long period of years on traffic to the major ports. These have arisen to meet the competition of canals and road vehicles, and no doubt in some measure, to competition between the railway companies when they were separate entities.

These rates operate greatly to our disadvantage, and the rates are so numerous that it is an impossible task to attack them in detail. The only solution will be to include in the new scale of rail charges now in course of preparation, a provision that any

*Address (slightly abridged) delivered to the Road Transport Conference at Cardiff on 24th September 1952, arranged by the Industrial Association of Wales and Monmouthshire and British Road Federation.

commodity to any port will be applicable to any other port pro rata on a mileage basis. We are in touch with the Railway Executive on this point.

Dock Charges.

Because Liverpool is our chief competitor, let us compare the position of the shipper at that port, although it must be borne in mind that the conditions ruling there apply similarly or to some extent at other ports.

A shipper in the Midlands sends a consignment by rail to Liverpool. The rate charged by the Railway Authority includes a terminal charge covering the cost of putting the consignment on the floor of the shed at the loading berth. From that point the ship bears all subsequent cost other than Mersey dues.

ship bears all subsequent cost other than Mersey dues.

No such equivalent prevails in the South Wales Ports, and the rail rate only includes delivery to shed or alongside loading berth; in Swansea only to the dock junction. All charges for unloading in shed and subsequently shipping, or for shipping direct ex lorry or railway vehicle, must normally be paid by the shipper, in addition to wharfage dues. This position is aggravated by the fact that shedding may be necessary in order that cargo may conveniently be selected for stowage purposes, but the shipper must still pay the cost, as under present custom of the ports, all charges, however incurred, to ship's rail, are for shippers' account. In a recent shipment where the traffic arrived on the shippers' own lorries, which at Liverpool they would have discharged to the shed floor themselves, the costs in South Wales were twelve times as much.

The General Cargo Sub-Committee have devoted much time and thought to this problem, and have had discussions with the Ministry of Transport, the Railway Executive, the Dock Executive and the leading Shipping Lines. As a result of these discussions we have obtained an undertaking from the Railway Executive that in the proposed new scale of charges the anomalies in terminal charges will be ironed out. That is to say, if terminal charges are included, or not included, all ports will have exactly the same conditions.

The Steamship Lines meanwhile have adopted the attitude that until we have obtained equity in the rail rates, no useful purpose would be served in discussing the question of the freight absorbing the charges, other than wharfage, from the point of delivery in shed, or alongside road or rail vehicles.

A deputation has recently waited on Sir David Maxwell Fyfe, stressing the vital importance of the early issue of the proposed new scale of rail charges, so that further progress may be made in removing this inequity which makes it impossible for our ports to compete on an economic basis.

To obtain equity with Liverpool and other ports, therefore, three main alterations must be made:

- All special rail rates must be available to the South Wales Ports on a mile to mile basis.
- (ii) All rail rates must give the same terminal services at the ports if terminal charges are included.
- (iii) The Steamship Lines must provide the same terms and facilities at all berth ports.

In addition we have got to recognise that a large proportion of Midland cargo is road traffic, and it we are to attract it and obtain it, we shall have to adapt our dock working to deal with it.

Road traffic is not suitable by and large for direct shipment. It is quite impossible in practice to arrange for it to arrive in the order required for stowage, and wet weather or delays to vessels bring it to a complete standstill. The only method that has been found satisfactory is to deliver to shed, an operation which can be carried out irrespective of weather or vessel's arrival.

Sufficient shed space must therefore be available, and when the proposed programme of improvements, together with suitable equipment, is carried out, there should be no shortage of space, but at present the high costs falling entirely on the shippers are a strong deterrent. Ultimately the only solution is to obtain the shipowners' agreement to absorb some of these costs, but mean-while the current method of charging for shipping direct or through shed is hindering development and is the cause of continuous complaints. Cargo is being diverted to other ports because of the high resulting costs to shippers.

Communication Difficulties of South Wales Ports-continued

The system varies somewhat in our ports, but in the Eastern ports the stowing costs are paid on weight or measurement, whichever is the greater, e.g. it the rate is 5s. per ton it is paid per 20 cwts or 40 cu. ft. whichever produces most, a basis which is accepted by the shipowner, and is indeed the basis on which freight is paid.

The shipper, however, whilst in theory treated on the same basis, is in fact treated quite otherwise. The rates for shipping general cargo are based on the following table:

(a) Up to 40 cu. ft. to a ton.

(b) Over 40 cu. ft. and up to 60 cu. ft. to a ton.

(c) Over 60 cu. ft. and up to 100 cu. ft. to a ton. (d) Over 100 cu. ft. and up to 140 cu. ft. to a ton.

(e) Over 140 cu. ft. and up to 160 cu. ft. to a ton.

(f) Over 160 cu. ft.

A shipper therefore, whose cargo measures 45 cu. ft. pays the same as for cargo measuring 60 cu. ft. although the shipowner only pays stowage on 45 cu. ft.; cargo measuring 61 cu. ft. must pay the same as cargo measuring 100 cu. ft. Surely the equitable basis is per 40 cu. ft.

With shredded traffic the situation is even worse. Cargo up to 40 cu. ft. pays 8s. 9d. per ton, whereas if it measures 41 cu. ft. the charge is 17s. per ton, although cargo of 100 cu. ft. and more

only pays the same.

It is quite certain that any shipowner willing to absorb part of such charges will object to pay such charges on a different basis to that operated for stowing, and meanwhile, as I have stated, it is operating adversely on our efforts to secure more trade.

Again, although it is becoming more and more essential to cope with and attract road traffic, as it is not possible to have allotted berths for particular trades or lines, neither the Dock Authority nor the shipowner can say with any certainty at which berth the vessel will be able to berth alongside the shed utilised by the shipper, and if it does not, the shipper is called on to pay another 2s. per ton for transfer charge.

Few charges have aroused such bitter comments from shippers, and most certainly and obviously, this is not the way to attract

general cargo to our ports.

If all these matters are righted we shall at any rate be in a position to compete but it must be frankly admitted that, although in some cases we have persuaded the shipowner to absorb wholly or in part, some of these charges, and place us on a parity with Liverpool, we still have not succeeded in any great measure in securing Midlands traffic.

What further factor stands in the way? Probably the most stubborn and difficult factor of all—to succeed in disturbing the

" status quo."

Established Customs.

The Midlands shippers have for a century or more built up their trade over Liverpool and London. It will never be enough to merely be able to say it will not cost any more to ship over South Wales—we must be able to offer a definite advantage economically or in some other way. The disadvantages under which we still labour can be summed up as follows:

(i) In many cases shipment can be made by the same vessel at Liverpool 7-14 days later, giving the shipper more time for manufacture and delivery. Sailings are also at more frequent intervals.

(ii) Shipowners have their own canvassing organisations in the Midlands, and naturally route cargo through their home

ports, as has always been their practice.

(iii) Shipping and forwarding agents in the Midlands also naturally route traffic through ports where they have their own offices, and until they open offices in South Wales, are not likely to be helpful.

(iv) North of Birmingham, mileage is against us, and most industries lie to the North and East.

Finally, there is prevalent in South Wales and idea that if we could get a reasonable share of Midlands traffic, vessels could load full cargoes in our ports, and so dispose of the first of these disadvantages.

I have never held this view. I have analysed manifests of vessels loading in Liverpool and London, and the combined exports of the Midlands and South Wales are not normally enough for full cargoes, particularly as the lighter measurement goods such as textiles, are mainly produced in the North.

In fact today very few vessels can obtain enough cargo at one port, and it requires South Wales, Liverpool and Glasgow for example, to supply the shipowners' ideal—a full ship down to

her marks.

In regard to the second disadvantage, it has to be remembered that shipowners largely use agents in these ports, and they would not view with approbation efforts on the part of their agents to canvas for traffic in the Midlands, as any success would be at the expense of Liverpool.

The big shipping and forwarding firms are now taking an interest in South Wales. Taking the long view it would be to the advantage of our ports if they opened up offices here, although it might mean loss of business to local individual firms. They would then be more inclined to route traffic in our direction, and their local offices would be eager to obtain all that is possible.

The last disadvantage is a geographical one which cannot be altered. The Midlands is a general term and nobody has so fir made any research into the possible cargo that might emanate

from the geographical economic area.

It has been claimed that geographically the West Midlands, comprising the Birmingham, Walsall, Wolverhampton and Stourbridge area could well be served by the South Wales Ports which are nearer this area than London or Liverpool. Moreover, there would, in many instances, be a saving in sea miles by exporting through the local ports which for example are nearer than either London or Liverpool to the ports of North America. A further point is that the vast flow of the nation's exports resulting from the abnormal level to which trade has been stepped up must place extremely heavy burdens upon Merseyside and London. With improved road communications the South Wales Ports would undoubtedly be better placed not only to ease this burden but also to serve what might be termed the geographically economic area of the Midlands.

Bulk cargoes in increasing quantities are being imported through the South Wales Ports to feed our gigantic heavy industries but much of the processed and semi-processed products must ultimately be conveyed to the Midlands thus making it vitally essential that the road link with South Wales shall be capable of carrying this ever increasing volume of traffic.

Furthermore the fact that the existing roadway between Birmingham and South Wales is a single carriageway for almost its entire length allows only one stream of traffic in each direction. This must cause delays to vehicles with resultant increased transport costs but as I said at the outset I have dealt with this subject from a shipping angle and do not consider myself competent to deal at length with this particular feature.

Increased Trade at the Port of London.

The report of the Port of London Authority for the year ended 31st March recorded that the net register tonnage of shipping using the port during the year totalled 57,692,297 tons. more than three million tons above the corresponding total in the previous year, and nearly 93% of the tonnage entering and leaving the port in the year ended 31st March, 1939. The total tonnage of import and export goods passing through the port was over 49 million tons, a figure which exceeded the total tonnage of the previous year by more than four million tons and was the highest recorded annual tonnage of goods for the port. The year's working produced a total revenue of £13,460,240 and a total expenditure of £10,133,348, leaving a balance of £3,326,892. After deducting various items and special appropriations, there was a surplus balance for the year of £2,226 which, with a surplus of £586,972 brought forward from the previous year, left a surplus of £589,198 to be carried forward.

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New Jetty for Oil Tankers at Thames Haven

Prestressed Concrete Beams and Suspended Fenders

(Specially Contributed)

A jetty at Thames Haven has just been constructed by the London and Thames Haven Oil Wharves Ltd., for large oil tankers which bring crude oil to the adjacent reference at Shell Haven.

refinery at Shell Haven.

The structure is "L" shaped in plan (see Fig. 1) with an approach (Fig. 2) 414-ft. long and 23-ft. wide and a jetty head (Fig. 3) 240-ft. long and 40-ft. wide. The oil pipes are carried on either side of the approach and along the centre of the jetty head with timber bridging where necessary to allow for access over the pipes at the end of the approach. There will be provision for two 12-in. diameter lines, three 10-in. diameter lines and five 8-in. diameter lines. There is a 5-ton samson post at the front centre of the jetty head which will be operated by two electric winches. There is also provision for an additional samson post and winches on the downstream end of the jetty to allow for possible future duplication of the oil pipes.

The construction is unusual in that prestressed concrete beams are used to support the deck, and the fenders, also of prestressed concrete, are of a horizontally-suspended type.

Temporary Works.

The principal temporary works were a casting yard on the river bank and a temporary staging extending from the shore along the downstream side of the approach and along the front and back of the jetty head. A crane track from the casting yard extended the entire length of the staging and carried four 7-tons steam locomotive cranes. At the casting yard the crane track was on a concrete slab because of the poor nature of the ground, and on timber trestles on concrete foundations between the casting yard and the river bank. The staging in the river

consisted of 12-in. by 12-in. broad flange beams 70-ft. long driven as piles with timber bracing and steel tie-rods; the crane track being carried on 24-in. by $7\frac{1}{2}$ -in. steel beams.

Substructure.

The substructure of the approach and jetty head consists of hollow reinforced concrete cylinders filled with concrete. The cylinders. which were precast, are in sections each 8-ft. long and have ogee joints. The external diameter is 8-ft. 3-in. and the thickness 41-in. The bottom edge of the lowest section had a steel cutting edge. The sections were brought to the site by road, stored in barges until required, and were erected in a steel guide-frame (Fig. 4) to maintain the alignment while being sunk. The height of the cylinders varies with the level of the ballast on which they are founded; the greatest height is 80-ft., although while the cylinders were being sunk the height was 92-ft.

A temporary section with a thicker wall and a steel cap was placed on the top of each cylinder to carry the platform for the cast-iron kentledge, the action of which in sinking the cylinders was assisted by excavating inside the cylinders with a ½ cu. yd. orange peel grab, the spoil being dumped into barges. The average weight of kentledge required to sink the cylinders 24-ft. to 36-ft. was about 54 tons. After each cylinder was sunk, mild steel reinforcement was placed in it and it was then filled with concrete to above low water level. Concreting proceeded in a continuous operation through a tremie suspended from a steel tower (seen on the left-hand side of Fig. 1) which was moved by two steam cranes from one pier to the next.

The Approach.

The approach (Fig. 2) is supported intermediately on three piers of one cylinder each, a pair of cylinders at the jetty head end, and two 18-in, diameter bored piles in the river bank. Cast-in-situ reinforced concrete caps 15-ft. by 9-ft. and 30-in, deep are provided on the single cylinders to carry the deck beams.



Fig.1. Jetty in course of construction.

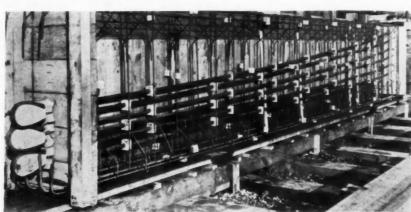


Fig. 5. Inflated rubber tubes forming cores for prestressing cables

In each of the four spans of the approach, which have a clear length of 77-ft., there are two longitudinal prestressed concrete I-beams. The beams, which are 4-ft. 6-in. deep, are at 12-ft. centres transversely and are connected by cast-in-situ reinforced concrete transverse webs 9-in. wide at each of the third-points and 15-in. wide over the piers. The deck comprises 5-in. precast slabs 2-ft. wide and 23-ft. long, which cantilever about 5-ft, beyond the edge of the main beams to which they are secured by fish-tail bolts.

Each longitudinal beam was made in three sections about 25-ft. long, which were placed in position in the jetty on a temporary staging. A gap 0-in. wide was left between the ends of each section and was filled when the cast-in-situ transverse webs were cast. The three sections were formed into

New Jetty for Oil Tankers at Thames Haven-continued

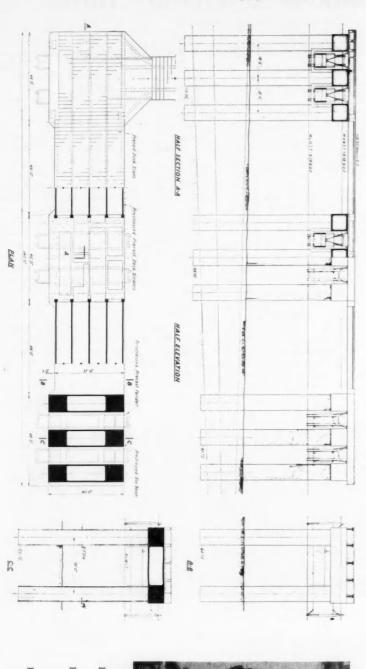
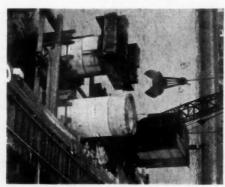
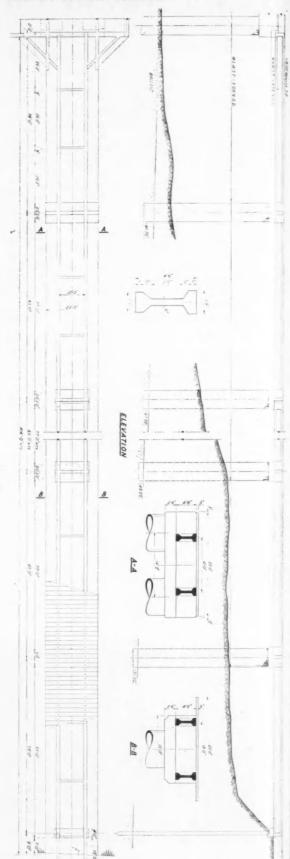


Fig. 2 (top). Details of approach.
Fig. 3 (left). Plan, elevation, and sections of head of jetty.
Fig. 4 (above). Temporary trestle and cylinder for approach.





New Jetty for Oil Tankers at Thames Haven_continued

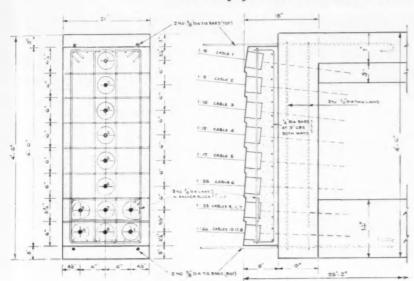


Fig. 6. Precast anchorage block

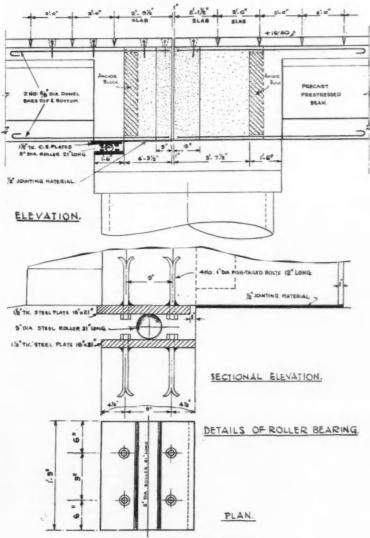


Fig. 7. Expansion joint in approach.

one structural member by the prestressing wires which were threaded through 1 5/16-in. diameter ducts formed by inflated rubber tubes when the sections were cast. Each length of tube formed two ducts, since it was brought through the end shutter and passed around a wooden template as shown in Fig. 5. The tubes were held in position by rectangular concrete blocks threaded on them and secured by tying-wire to the vertical stirrups in the beam. Before the concrete was placed the tubes were inflated, and when the concrete had hardened they were deflated and withdrawn for re-use. A precast concrete block (Fig. 6) containing the cones in which the prestressing wires are anchored, is embedded in the end of each A gap 6-ft. long was left between the ends of the main beams to enable the jacks to be manipulated. After prestressing the 6-ft. gap was filled and the transverse 15-in. web was cast-in-situ. Four 5-in. bars, projecting from the ends of the precast beams, tie the beams to the cast-in-situ construction over the piers.

The beams were cast in sections in timber moulds erected on a timber grid laid on the ground in the casting yard. concrete was mixed in a ½ cu. yd. non-tilting drum mixer discharging into a 1 cu. yd. bottom-opening skip which was lifted by a crane and emptied on to a stage, from which the concrete was placed in the moulds by shovels. The concrete was consolidated by vibration, and rapid-hardening Portland cement was used. The deck slabs were cast in wooden moulds, from which they were lifted after about four days. which weigh up to 11 tons each, were picked up by the crane at the casting yard and carried to the shore end of the temporary stage, where another crane transported them to the work.

An expansion joint (Fig. 7) is provided over one of the piers of the approach. Two transverse webs are separated by a gap 1-in. wide. One pair of beams and one web are cast monolithic with the head of the pier, the other pair of beams and the other web being freely supported on the pier. A roller joint is provided under these beams by an upper and lower 11-in. manganese steel plate bolted to the concrete of the beam and pier respectively, with a 5-in. diameter manganese steel roller 21-in. long between.

The Jetty Head.

The support of the jetty head (Fig. 3) is provided by three dolphins each comprising six cylinders, three at the front and three at the back. Each pair of the six cylinders is connected by a transverse prestressed concrete box-beam 40-ft. long, 9-ft. wide, and 8-ft. 6-in. deep. A pair of fenders is provided at each dolphin and lies between the box-beams. The dolphins are connected by five parallel prestressed concrete I-beams each 52-ft. long, on which are laid 4-in. precast slabs 9-ft. long and 2-ft. wide.

Each box-beam (Fig. 8) comprises six precast open rectangular reinforced concrete sections, each 2-ft. 8-in. wide with 7-in. walls, laid between two cast-in-situ heads

New Jetty for Oil Tankers at Thames Haven_continued

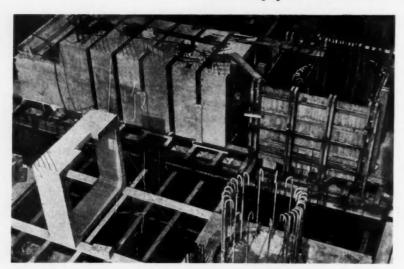


Fig. 8. Prestressed concrete box-beams in head of jetty

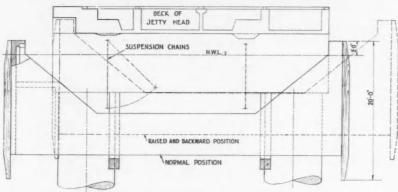


Fig. 9. Diagram showing action of fenders.



Fig 10. Suspended fender in course of construction.

on the cylinders. The sections were erected with a 6-in. space between each, the space being filled in situ. Ducts in the walls of the sections enabled cables to be passed through from one head to the other. Stretching and anchoring of the wires formed the sections into a hollow prestressed concrete beam spanning between the cylinder heads, and with the cylinders form a rectangular frame. Horizontal forces acting on the jetty head are thereby resisted at each dolphin by three parallel transverse frames.

The 52-ft. beams between the dolphins were cast complete and prestressed in the casting yard. Three mould bottoms and one

pair of mould sides were provided. A platform over the space for the three moulds enabled the concrete to be placed from above from a skip. The beams were prestressed ten days after casting, when the crushing strength of the concrete was not less than 6,000 lb. per sq. in. When each beam had been pre-stressed, it was lifted by two cranes and carried to the jetty head.

Concrete for filling the cylinders and for cast-in-situ work in the jetty head was mixed in a barge. Fine and coarse aggregates were stored at opposite ends of the barge. and cement was stored under cover along one side. A $\frac{1}{2}$ cu. yd. non-tilting drum mixer was placed amidships and discharged into $1\frac{1}{2}$ cu. yd. bottomopening skips which were taken by crane from the barge to the point of placing.

The Fenders.

There are six gravity-operating suspended fenders each of which is a prestressed reinforced concrete box 48-ft. long, 7-ft. 6-in. wide, 14-ft. deep at the ends and 6-ft. at the middle, and weighs 56 tons in air and 30 tons when immersed in water. Each fender is suspended below the deck of the jetty head by four 24-in. diameter chains in such a position that it projects 0-ft. in front and 2-ft. at the back of the jetty head (Fig. 9). When struck by a vessel the fender moves inwards and upwards; the energy each fender can absorb, when immersed, is 90-ft.-tons. The fenders were cast on the dolphins in steel shutters (Fig. 10). After prestressing they were lowered by chain blocks and then suspended below the deck. Two timber rubbing pieces are provided at each end.

There are six Bean bollards on the face of the jetty to take the springs of the tankers, and there are two mooring dolphins at the upstream and downstream ends of the jetty to take the breast ropes. These mooring dolphins each consist of eight 12-in. by 12-in. B.F.B. piles which were obtained from the temporary work of the main jetty structure. The piles are arranged in two rows, the front row consisting of four rakers with a 1:6 batter and the back row consisting of four vertical piles. The piles are suitably braced and have a timber platform on top 13-ft. square. There is a mooring bollard in the centre of the platform and access ladders are arranged one at the front and one at the downstream side of each The head and stern ropes are secured to dolphin. mooring buoys, two at the upstream end of the jetty and one at the downstream end. The second buoy at the downstream end has been replaced by a bollard on another jetty which has just been constructed. The whole of the jetty head is surrounded by galvanised removable guard railing with two rows of chains between each stanchion. There is a row of fixed hand railing on either side of the approach consisting of galvanised iron stanchions and 1-in. diameter solid drawn galvanised iron rails.

The jetty is illuminated at night with fluorescent lighting. There are five reinforced concrete standards on the approach each carrying a single 80-watt gas proof fluorescent unit. On the jetty head there are seven reinforced concrete standards each carrying a 400-watt gas proof fluorescent unit, consisting of five 80-watt

tubes

Construction of the jetty commenced in May, 1950, and was put into service at the beginning of August, 1952. The cost was about £300,000. The joint consulting engineers were Mr. Thos. C. Rolland and Messrs. L. G. Mouchel and Partners, Ltd., who, in conjunction with Port and Harbour Fenders, Ltd., designed the fenders which are based on the patented design of Professor A. L. L. Baker. The contractors were Messrs. John Mowlem and Co., Ltd. The precast cylinders were made by Spun Concrete Ltd. The beams were prestressed by the Freyssinet system.

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Structural Timber for Dock Work

1. A Review of considerations involved by the extended use of Timber for the Construction of Shed Buildings

By P. O. REECE, A.M.I.C.E., M.I.Struct.E., A.M.I.Mun.E.

HE war damage sustained by dock and harbour installations in the United Kingdom has been estimated at about £35 million. Much of the necessary reconstruction has already been carried out but, even if there were no extraneous obstacles, it would probably take at least four to five years to complete the balance of the programme. In the meantime, as with most other projects of capital investment, the work is beset by new difficulties arising in part from a world shortage of raw materials and in part from our domestic problem of meeting an imports bill on a scale sufficient to maintain the overseas earning capacity of our industries. A recommendation that the Government should make a special allocation of steel for the repair of war damage and the provision of transit sheds at the docks in London and Liverpool has been made in a report of the Ports Efficiency Committee. The smallness of the quantity required—only 10,300 -gives point to the difficulty with which the Government is faced in meeting essential requirements from a dwindling stockdifficulty which makes it abundantly clear that every possible source of alternative material must be examined.

Raw Materials

From the point of view of the structural engineer, the materials which will determine progress are steel, cement, aluminium and timber. Of these, steel and aluminium grouped together under the heading of "Ores and Metals" form the biggest single item on our raw materials import bill—in 1951 accounting for approximately £336 million; cement is home-produced, but has for many years been produced to capacity at about 10 million tons a year; while timber occupies fourth place on the import bill at £244 million.

The availability of steel and aluminium is likely to be determined by world production and rearmament for some considerable time, while cement is already consumed on a bigger scale than ever before. There is no world shortage of timber, but the considerations which are impeding its structural use on an extensive scale are none the less important, deriving as they do from the necessity to maintain expenditure outside the Commonwealth sterling area at the lowest possible level and also from the lack of development in the structural use of timber in the United Kingdom between the two world wars.

The principal sources of softwoods are Canada—which is in the

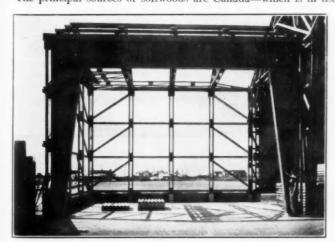


Fig. 1. Built-up plywood portal frame garage entrance, 27-ft. span, 20-ft. high, glued and shop assembled in three parts. Bolted together on site.



Fig. 2. 45-ft. span timber storage building in Idigbo, incorporating a modification of one of the T.D.A. Standard Industrial Roof Trusses.

Commonwealth but not in the sterling area — and the Baltic countries, which are neither in the sterling area nor the Commonwealth. In consequence, the Government has set a global limitation on the amount of softwood which may be imported and has maintained the limit at somewhere about half our pre-war imports, while a rigid licensing system is still imposed on consumption seven years after the end of the war which brought Timber Control into being.

Both hardwood and plywood can be, and indeed are, imported and manufactured in large quantities and are free of consumer licensing over a very wide range of species and qualities. That engineers are not making as great a use of these as they might is probably due in part to their unfamiliarity with the materials and, in a lesser degree, to the rather higher cost of hardwood and plywood structures by comparison with softwood. These structures are, in fact, a little outside the general run of the British engineer's experience, but progress has been made and there is no reason why a much more extensive use should not be made of the stocks available in this country (see Figs. 1 and 2).

Owing to there being hardly a trade or industry which is not concerned with timber in one form or another, timber is a factor which enters into nearly every sector of our internal and external trade relations and, consequently, the arguments in favour of the greater use of softwood necessarily cover a field beyond the scope of an article of this nature. Many of the arguments have, nevertheless, a direct bearing on the engineer's attitude towards his material and perhaps the most important is the question of physical availability.

The output of most of the synthetic or manufactured materials is limited either by the amount of processing capacity available or by one or another of the essential ingredients being physically in short supply. Cement production, for instance, has steadily increased since the end of the war, but the rate of increase has inevitably diminished as the capacity of existing plant has been reached and as the need for new capital investment has become more pressing. The result of this process is that it is probably impossible to increase output by more than about 4% per annum without a very considerable diversion of funds and labour to the construction of new plant. In 1951, for the first time since the war, the production of steel was less than in a previous year. The shortage of scrap, iron ore and coke have been the determining factors on output and consumption has only been maintained by drawing on stocks and by the increased import of finished steel. Even in sections of the industry where, by one means or another, apparent output has

Structural Timber for Dock Work-continued

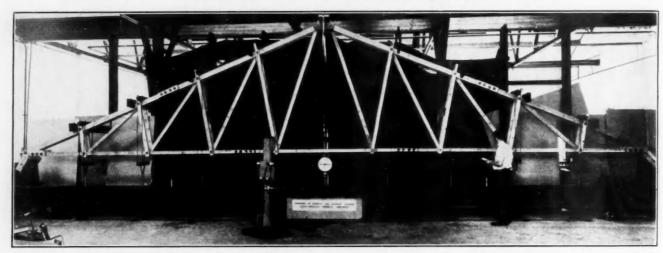


Fig. 3. T.D.A. Standard Industrial Truss under test at Forest Products Research Laboratory. (Crown copyright reserved. Reproduced by permission of the director of the Forest Products Research Laboratory.)

been increased, it is evident that the rate of increase has been falling over the years and, in general, it would seem optimistic to look for more than from 1% to $1\frac{1}{2}\%$ increase without disproportionate increases in capital investment and imports.

These small and probably costly increases in production will have a proportionately small effect on the raw materials problem. If any new policy is to make a measureable impact on production, it must be by increases of a much bigger order. By comparison with the figures mentioned, the rate of softwood imports could be increased by at least 25% in the first 12 or 18 months, with no capital outlay on industrial plant, with no measureable diversion of labour and productive capacity, and probably with a general reduction of unit prices.

And the import bill? A 25% increase in softwood imports would put perhaps £17 million on the debit side. It would release for the credit side about £30 million of steel or £100 million of aluminium, or some combination of both.

A review of raw materials policy cannot long be delayed if a disastrous fall in productivity is to be avoided. In the meantime, stocks of timber are available, hardwood and plywood can be used without licence and, in accordance with the Timber Economy Memorandum issued by the Ministry of Works, softwood will be allowed for approved structural purposes.

Economy

In beams and slender struts and in components or parts the strength of which is governed by their elastic stability, variations in the dimensions of their cross-section have, in general, a greater effect on their strength than have equal variations in the mechanical properties of the material. From this it may be shown that if comparison is made between two materials of the same strength/weight ratio but of different densities, the lower density material will be the more efficient for the purposes mentioned owing to the

Table 1. Physical properties and permissible working stresses of structural materials.

	Specific	Nodulus	Working Stresses				
	gravity			Tension	Compression	Shear	
		lb.per sq.in.	lb.per sq.in.	lb.per sq.in.	lb.per	lb.per	
£11a steel	7.86	30 x 10 ⁶	22,400	20,160	20,160	14,560	
Aluminium 61loy (AW 108)	2.70	10.3×10 ⁶	16,016	14,560	14,560	€,96	
Reinforced concrete (1:2:4)	2.30	2.0x 10 ⁶	1,000	-	760	100	
Douglas fir	0.48	1.6x106	1,000	1,500	1,000	100	

greater thicknesses afforded by the same weight of material.

In ties and stocky struts, variations in dimensions are, in general, of equal importance to variations in mechanical propertics, and in these cases the strength/weight ratio becomes a criterion of efficiency irrespective of variations in density.

These ideas can be generalised by employing the criterion of specific strength, here defined as the load sustained by a unit weight of structural material under a particular condition of loading; its usefulness as a criterion lies in the extent to which it can direct attention to the conditions of loading under which one particular material has a higher efficiency than another. In geometrically similar sections of materials of different densities, it may be shown that:—

$$A \propto \frac{1}{\hat{g}}$$
 $Z \propto \frac{1}{g^{1.5}}$
 $Z \propto \frac{1}{g^{2.5}}$

Where g is the specific gravity of the material and A, Z and J have their customary meanings of cross-sectional area, modulus of section and moment of inertia respectively. From these relations, we can establish the criterion of specific strength for different conditions of loading, thus:—

In tension, direct compression and shear,

Specific strength
$$\propto \frac{p}{g}$$

In tension.

Specific strength
$$\propto \frac{D}{g^{1.5}}$$

In flexural rigidity (EI)

Specific strength
$$\propto \frac{E}{g^2}$$

where p is the working stress and E modulus of elasticity.

Table 2. Specific strength of structural materials.

Material	Flexural rigidity	Bending	Tension	Compression	Shear
	E	E	P	p.	p
	E2	71.5	-	-	-
	6	5.0	8	ě.	8
ild steel	0.49 x 10 ⁶	1,016	2,565	2,565	1,852
luminium alloy	1.41 ×10 ⁶	3,610	5,393	5,393	3,319
Reinforced concrete	0.38 x 10 ⁶	287	-	330	43
ouglas fir	6.94 x 10 ⁰	3,007	3,125	2,083	208

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Structural Timber for Dock Work-continued

Applying these relationships to the common structural materials at normal working stresses, it is possible to calculate their relative economy, as shown in Table 2, Table 1 giving the physical properties and stresses upon which the calculations have been based. This calculation shows that in flexural rigidity, timber (Douglas fir) is superior to steel, concrete and aluminium, but takes second place to aluminium in bending and tension and third place to aluminium and steel in direct compression and shear. Evidently, timber is a particularly suitable material for structures of a kind which have a load-carrying capacity determined by some function of E.I. The most obvious example of this kind of structural component is, of course, the long slender strut, but the broader generalisation will include all structures which are large in relation to the loads they carry and in which stiffness is the essential requirement. Single-storey shed buildings undoubtedly fall within this class and, as might be expected, considerable material economies can be shown by timber in comparison with other materials for this class of building.

It is, of course, difficult to find a sufficient number of completely worked out designs in the different materials for precisely similar shed buildings, but a considerable amount of work has been done along these lines so far as simple roof constructions are concerned

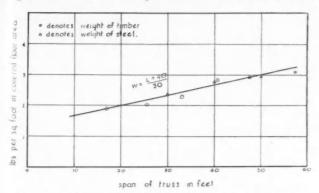


Fig. 4. Weights of timber and steel in trusses and purlins per sq. ft. of covered floor area.

In connection with the drive for steel economy, for instance, economical designs have been prepared by Government departments to establish the quantity of steel required in trusses and purlins per sq. ft. of covered floor area. The result of this research suggests that steel consumption can be limited to requirements expressed by the following relationship:—

$$w_{_{\rm S}} = \frac{1+40}{30}$$
 (1)

where

 ${
m w}_{_{
m S}}={
m the}$ weight of steel consumed in trusses and purlins in lbs. per sq. ft. of covered floor area, and

1 = the span of truss in feet.

Similar research carried out by the Timber Development Association over the past few years has produced a series of standard designs for timber roof trusses, most of which have been subjected to official test by the Forest Products Research Laboratory. For licensing purposes, it is, of course, more convenient to express timber consumption in cubic measure rather than weight and the formula established as a result of this work is:—

$$v_t = 1 + 40$$
 (ii)

where

v_t = the quantity of timber in trusses and purlins in cu. ft. per 1,000 sq. ft. of covered floor area, and

1 = the span of truss in feet.

For the purpose of comparing the two results in the same terms, formula (ii) may be transformed into the unit of lbs. per sq. ft. Commercial practice is to take a standard of softwood, i.e. 165 cu. ft., as $2\frac{1}{2}$ tons. This is equivalent to something under 34 lbs. per

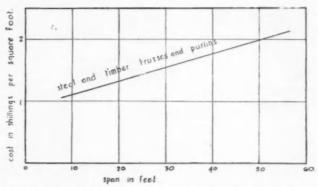


Fig. 5. Costs of timber and steel roof constructions per sq. ft. of covered floor area. Timber 22s. per cu. ft. Steelwork £70 per ton.

cu. ft. By taking the figure of 33.33 lbs. per cu. ft., however, formula (ii) will then give the same result as formula (i), i.e.

$$w_t = \frac{1+40}{30}$$
 (iii)

where

w_t = the weight of tumber in trusses and purlins in lbs. per sq. ft. of covered floor area (including waste) and

1 = the span of truss in feet.

The margin of error in making the foregoing assumption as to weight is very small compared with the errors inevitably involved in a general formula. Some of the results actually computed are shown in the graph of Fig. 4.

Taking sawn softwood, before fabrication, at £100 per standard,

Taking sawn softwood, before fabrication, at £100 per standard, costs of trusses and purlins have worked out at about 22s. per cu. ft. Applying this to formula (ii), costs of timber roof construction per sq. ft. are as shown in Fig. 5. This is equivalent to an erected cost at £70 per ton for steel construction.

Fire Hazard

There are some ten or twelve million homes in the United Kingdom with wooden roofs, floors, joinery and furniture. They are, for the most part, well stocked with highly inflammable furnishings and contents but, nevertheless, most fire offices would admit that our domestic fire risk is low. In spite of this, whenever timber is suggested for a use in which steel has become the tradition, the fact which tends to be considered to the exclusion of all others is that wood burns and steel does not.

We cannot overlook that the very stuff of our existence—food, clothing, furniture, furnishings, fats, chemicals—are all mostly combustible and, for the most part, highly inflammable. Add to this the normal processes of heating, cooking and lighting and it becomes obvious that some degree of fire hazard is an inevitable

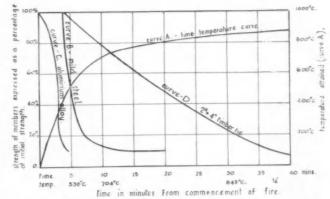


Fig. 6. Strength of steel, aluminium and timber in relation to standard fire test.

Structural Timber for Dock Work-continued



Fig. 7. Steel-framed building after five days' exposure to fire.

concomitant of human existence. In relation to the use of a combustible material of construction, the elements of fire hazard in descending order of importance can be listed as the probability of:—

- (1) The fire occurring.
- (2) Danger to life.
- (3) Damage to contents.
- (4) Damage to building.
- (5) Danger to surrounding buildings.

In general, fires must originate in tinder, that is, in combustible material in which the ratio of surface area to mass is sufficiently high to support combustion, even when only moderate heat is applied over a very small area. Professor Finch has classified tinder as "material ignitible by an ordinary match and which will subsequently support combustion." His more precise definition is that tinder has a specific surface of more than 20 sq. cm./gram.

Timber in the dimensions commonly associated with engineering is difficult to ignite and will not support combustion without heat being continually applied. The smallest section commonly used in a timber-framed structure would be, say, 2-in. x 4-in. This has a specific surface of anly 1.3 by comparison with the figure quoted and common experience will support the view that timber is not a suitable material for starting fires unless associated with sufficient tinder or until its dimensions have been reduced almost to shavings.

Assuming that proper arrangements are made for fire-fighting, for the provision of adequate means of escape and for the limitation of floor areas, etc., the danger to human life arises from the rapidity of the spread of fire and/or the collapse of the building. Rapid flame spread is associated, not so much with the structure as with the contents or with continuous linings of combustible material having a high specific surface, the importance of the structure itself lying chiefly in its fire endurance, that is to say, in the period for which it will withstand a prescribed heat and load without collapse. In this respect, timber is quite appreciably better than unprotected steel or aluminium alloy, as indicated by Fig. 6.

Steel loses strength rapidly as its temperature is raised above about 250° C.; at about 550° C. it has a little less than half its original breaking strength and loses 90% of its strength at about 750° C. Most aluminium alloys start losing strength immediately the temperature is raised; they are reduced to about half their strength at 300° C. and melt at about 600° C. These temperatures are significant when it is realised that ordinary building fires attain temperatures of from 700° C. to 900° C. Wood does not lose strength in the same way; in fact, its unit strength may increase with increase in temperature, owing to the reduction in moisture content; a wood member loses strength by reason of the material lost through the charring of the surface. It does not normally ignite until a temperature of about 250° C. is attained, and there-

after chars or burns at the rate of about 1-in. of depth in 40, minutes at normal fire temperatures.

The metals have a high thermal conductivity and consequently the dimensions of structural members made of steel or aluminium have little bearing on their fire resistance; this is not the case with timber, however. Wood has a low thermal conductivity, the thicker the member the less heat there will be to liberate inflammable gases in the middle of the timber and the less danger there will be of the wood burning through.

Curve A on the graph is a time-temperature curve reproduced from British Standard No. 476: 1932—"Fire Resistance, Incombustibility and Non-Inflammability of Building Materials and Structure." It is devised, as far as possible, to be analogous to the conditions obtaining in a building fire; the ordinates (with scale-on the right-hand side of the graph), indicating the temperatures attained at any given time after the commencement of the fire.

The ordinates of Curve B show the strength of mild steel—expressed as a percentage of the ultimate breaking strength at normal temperature—at the temperatures attained at different times after the commencement of the fire. Curve C gives the same information for a typically aluminium alloy. The data upon which Curve B is based are taken from a paper presented by Professor F. C. Lea to the Institution of Civil Engineers. (Proc. Inst.C.E.209).

From what has been said earlier, it will be clear that comparative figures for timber can be given only in respect of members of specific sizes. Further, as the information given relates only to tensile tests for breaking strength, the comparison must be limited to members for which this is a criterion, i.e. ties. Curve D is calculated to show the effects of the depletion of cross-section corresponding to charring at the rate of 1-in. in 40 minutes, for a 2-in. x 4-in. tie.

Taking into account factors of safety normally employed in design, the failure of fully-loaded ties would not occur until the strength value dropped to about 25% of the original. Comparing results at this level, we find the times taken to reach failure are as follows:—

- (i) Aluminium alloy ... about 3 minutes.
- (ii) Mild steel ... about $6\frac{1}{2}$ minutes.
- (iii) Softwood ... about 29 minutes.

From this it is clear that in buildings of a class for which unprotected steel or aluminium are acceptable, softwood of a minimum thickness of 2-in. will afford a vastly superior measure of fire endurance. To meet more rigorous requirements, fire retardant treatment and/or greater thicknesses of material, are the obvious remedy. For instance, where columns and beams are required to have a fire resistance of one hour, it is often provided by encasing steelwork or reinforcement with the minimum thickness of from 1-in. to 1½-in. of concrete. It seems clear from the foregoing that a fire endurance of one hour can be assured at less cost by a soft-



Fig. 8. Timber framework after severe fire (note water tank still supported by charred beams).

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Structural Timber for Dock Work_continued

wood structure, provided the thicknesses used are not less than 4-in., or, alternatively, by encasing steelwork with 1½-in. of timber.

The pros and cons of timber construction so far as item 3—Damage to Contents—is concerned, are inherent in what has already been discussed. Item 4—Damage to Building—raises an aspect of particular importance in certain classes of building with heavy masonry or brick walls. Here, war-time experience has shown that walls of sufficient resistance to contain fires successfully, have been pulled down through the distortion of incombustible roof structures, while timber roofs have, in many cases, burned away and left the walls unharmed.

Probably the most important implication of Item 5—Danger to surrounding buildings—arises from the extent to which a timber structure can be regarded as contributing combustible matter to an already existing conflagration. It is in this respect that a sense of proportion is essential. To assist in this, recourse may be had to the conception of "fire load" as defined by the Joint Committee on Fire Grading of Buildings. The term was used to describe the number of British Thermal Units which could be liberated per square foot of floor area of a compartment by the combustion of the contents of the building and any combustible parts of the building itself. It is determined simply by multiplying the weight of all combustible materials by their calorific values and dividing by the floor area under consideration.

From data obtained from a number of sources, the Joint Committee found that the fire load of residential buildings, hotels, hospitals, schools, offices and similar occupancies did not exceed

roo,000 B.T.U.'s per square foot. This they designated as *low* fire load. This provides us with a useful yardstick to measure the contribution of timber construction. For a building with a span of, say, 50-ft., the amount of timber in the roof, including trusses, purlins and bracing, would not exceed about 2 lbs. per square foot. Taking the calorific value of wood at 8,000 B.T.U.'s per lb., this is equivalent to a fire load of 16,000 B.T.U.'s per square foot, or less than one-sixth of what has been defined as a *low* fire load. At the other end of the scale, a very high fire load might be as much as four or five million B.T.U.'s per square foot. In such a case, the timber roof might be adding something less than half of 1% to the fire load.

To sum up, it is submitted that a timber-framed shed is at least as good a fire risk as one constructed with unprotected steel or aluminium and that structures of yet a higher fire resistance can be constructed in timber if attention is paid to:—

- (a) The use of incombustible exterior sheathing, e.g. brickwork, asbestos cement, galvanised steel.
- (b) The elimination of continuous linings of combustible material having a high specific surface.
- (c) The reduction of specific surface in the structure by the use of thick sections, the avoidance of criss-cross patterns, such as the Belfast roof truss, the planing of surfaces and the rounding of arrises.
- (d) The use of suitable fire retardant treatments.

(To be continued)

The Stowage of Cargo

Differences between Theory and Practice

By GEO. B. LISSENDEN, M.Inst.T.

In the ninety-fifth annual report of the Mercantile Marine Service Association reference is made to "The recent epic story of the master of the American vessel Flying Enterprise and the foundering of that ship. The report goes on to say that "masters should make certain that shore stevedores do not influence them into accepting stowage which may render the ship unsafe if heavy weather is encountered. Responsibility for taking an inadequately stowed vessel to sea is not the stevedore's but the master's, and if later on, through heavy weather or accident, it appears that the ship was unseaworthy on account of the stowage, it is the master's certificate and perhaps the lives of his crew which are in jeopardy, not the stevedore's business."

As to that there can be no two opinions: in the final analysis it is, of course, the master who is responsible for the stowage of his ship. But what are the facts? Consider, first, what usually happens before a vessel sets sail from her "home" port.

Theory and Practice.

To begin with, it is obvious that before a stevedore can commence to load a ship with general "outward" cargo he must know in advance if he can—and we say "if he can" advisedly—within a little, what tonnage he has to put into the vessel, so that he can stow the goods in the order of the port of call, putting in first those consignments which are to be the last out of the ship, and those in last which are to be taken out first.

But one of the difficulties which the stevedore is always up against is that, although the shipowners themselves, as well as the shipping and forwarding agents, impress upon intending shippers that they must have their goods delivered at the ship's loading berth by a given date, so many consignments arrive late—and some of them a day or two after all the parcels for that particular port have been put into the ship. This means either that these late arrivals have to be put somewhere else—somewhere where they should not be put and stand the chance of being discharged at some intermediate port of call—or be shut out altogether. Late arrivals are, in fact,

the bane of the stevedore's existence—or, rather, one of his major worries.

Theoretically, a ship should be stowed in the manner indicated, i.e., so that at the first port of call the goods required for discharge there are right in the square of the hatch and at once get-at-able, with the light packages placed nicely on top of the heavy ones so that there shall not be any crushing; those required for off-loading at the second port of call immediately underneath those, and therefore readily available, and so on, port by port. But things do not work out that way in practice.

The stevedore endeavours to plan the lay-out of his receiving shed—the quay shed into which the shippers or their agents are invited to bring their goods—in such a way that, when eventually he begins to load the vessel, those packages and, in particular, the heavy ones, which are required for stowage in the very bottom of the ship, are close to the quay edge, with the lighter ones to follow in what—in theory—is their proper order.

But in nine cases out of ten the stevedore has to receive both from overside and ex the quay simultaneously—or to put it in another way: some goods are delivered to him both by railway and by road carriers, and these are deposited in the shed, whilst other consignments are taken to the export steamer by barge—and he therefore has to do his best to accept goods from both sides of the ship at one and the same time, lest his stowage plan be upset completely, and the trim of the ship be different from what it should be.

In fact, the stevedore must be constantly watching the trim of the ship, because it is most important that when a vessel arrives at certain ports she must not be drawing more than a given depth of water, and that she is on an even keel.

In short, an outwards cargo comprises consignments of all sorts, shapes and sizes, it is received from a hundred and one different shippers—each of whom expects special attention to his particular parcel, and notwithstanding all advice to the contrary, some exporters persist in holding their shipments back until the ship is nearly ready to sail, or they do not despatch them soon enough, which amounts to the same thing. The result is that, on the day of sailing, the stevedore is often enough at his wits end to know just what to do for the best. He is always conscious of the fact that if he shuts out some of the consignments there will be strong letters of protest from the senders; if he does not hatch up long before tide time the officers of the ship will have their say; and he will be in trouble with the shipowners either way.

Stowage of Cargo_continued

Imported Cargoes.

It is very much the same with many cargoes imported from abroad. Take a vessel plying to and from the West Coast of Africa, for example. On her arrival at Freetown she takes on board a number of Kroo boys and they go with her from port to port, doing whatever is necessary under the direction of the head man, "No. 1," who in turn is naturally subject to the instructions of the master of the ship, or the chief officer really, for it is the latter who superintends the handling of the cargo.

The West African produce is brought to the ship's side, not in nicely arranged parcels just ready to be hoisted on board, but some portions of it—the logs—are floated alongside and have to be derricked into the ship's holds, or on deck, as the case may be; other portions arrive in surf boats, and so on. Ex-quay loading is not the invariable rule on the West African coast. Indeed, it is not unknown for a master to have to navigate his ship in very shallow water to get to his loading point, such as it is. This defect is slowly being remedied—for example—at Takoradi, on the Gold Coast, where a good harbour, with up-to-date berthing facilities, is now nearing completion.

Much of the same sort of thing happens when a vessel is "coasting" farther afield. In America, Canada and Australia, for example, there are recognised longshoremen for the job. But because the vessel goes from port to port to pick up her cargo in bits and pieces, so to speak, the loading cannot be performed in accordance with any set pattern. All that the master of the ship—or his representative, the chief officer—can insist upon is that the goods shall be stowed in such a way as he thinks fit in the circumstances, and having regard to other parcels which are to be taken on board elsewhere.

The captain of a ship trading to the Far East has to grapple with the same problem. He may go to Penang, where there is a wharf and loading facilities. But if that wharf is already occupied, the ship may have to lay off somewhere and wait for her cargo to be brought off to her in lighters. The same can be said of Port Swettenham—which place is approached by a creek three or four miles long.

As Sir Wilfred Ayre pointed out in a paper which he read in London recently, before the Institution of Naval Architects. "Cargo, in many instances, has to be loaded from or discharged into barges, or from or to wharves devoid of handling facilities." When those conditions prevail expediency takes a hand. It is bound to—if there is not to be undue delay to the ship.

Bulk Cargoes.

With bulk cargoes—such as grain, ore, etc.—the loading and discharging of a ship is a simple enough matter: the cargo is snot into her by some mechanical means at the loading port and sucked or grabbed out of her at the port of discharge and the work proceeds smoothly.

It will be remembered that after the Flying Enterprise went down, there was some speculation as to whether the vessel's cargo of pig iron had been properly stowed. Concerning the stowage of this class of material the Mercantile Marine Service Association, in their ninety-fifth annual report remarked: "It is a well-held theory that pig iron if properly stowed will not shift, but this theory in turn depends upon the interpretation given to the term 'properly stowed." In the Mill Hill enquiry and at the subsequent appeal court, the Association's lawyers indicated that none of the recognised text books give detailed instructions as to how pig iron should be stowed."

With a dead-weight cargo—of, for instance, ore, scrap iron and the like—very little difficulty arises: the placing of the material in the ship and her subsequent trim are a good indication to the master whether she is, or is not, "safe." In the case of anything that is likely to shift in bad weather, however, e.g. grain—temporary bulkheads and "shifting boards" will naturally be used for security purposes.

For the reasons above, therefore, it is not practicable to issue a set of instructions to the master of a ship taking in a general cargo at her "home" port, or when she is "coasting" abroad, specifying just how this, that and the other must be loaded and where.

For the sake of all concerned, if he is loading on the West Coast of Africa, for example, the master would like to have his vessel nicely floored out—longitudinally—with the mahogany logs and the bagged kernels, copra. and whatever else there is to be brought home, stowed on top of that log flooring. But he knows that there are times when at least some of the logs must be carried on deck and he has them placed there.

In July last, Lloyd's Register of Shipping issued a notice drawing Owners' attention to the important influence of longitudinal distribution of cargo. This note referred particularly to shelter deck cargo ships of about 9,000 to 10,000 tons deadweight and a length of about 400 to 430-ft., having large capacity deep tanks fitted amidships either forward of or abaft the machinery space.

In the fully loaded condition with cargo at a uniform rate of stowage throughout all spaces except the deep tanks, which are left empty, the longitudinal hogging moment is greater than if the cargo is stowed at a uniform rate throughout all spaces, including the deep tanks. Accumulating evidence from the Society's records indicate a significantly increased liability to main structural damage in heavy weather with the former distribution of loading.

Ideally, cargo should be "stowed at a uniform rate throughout all spaces, including the deep tanks" but, sufficient has been so id to show why, on occasions, something less than the ideal has to be accepted.

Pilferage at New York Docks

Work of Port Watching Agencies

Precautions against dockside theft and pilferage in New York are outlined in an article in "Via the Port of New York," house journal of the New York Port Authority.

New York, the article points out, is the only United States port which has set up an organisation to combat the pilferage problem. Known as the Security Bureau, it is composed of representatives of shipping and insurance companies, road hauliers, drydock and ship repair firms, harbour transport and towing companies, warehouse and stevedoring companies and port watching agencies. The work of the Security Bureau, according to the journal, "has materially reduced theft on the waterfront of the world's greatest port."

The problem is attacked in a number of ways. Basically, however, the backbone of protection efforts is the port watching agency. A port watching agency is just what its name implies—an organisation which supplies watchmen to guard waterfront properties against theft and pilferage and to perform other services for the protection of both cargo and passengers moving through a port.

Before the war the greatest emphasis in the work of a port watching agency was on the protection of passenger ships and passengers. To-day, while this is still one of its major functions, there has been a gradual increase in the importance given by these agencies to the protection of cargo.

In its work of preventing pilferage, the Oceanic Service Company assigns guards to each pier it protects. "Approach a pier entrance," the article continues, "and unless you and your business are known to the watchman you will be stopped and required to identify yourself and your errand. The gate watchmen keep an eagle eye on all persons entering and leaving piers, and bags or packages they carry. They inspect departing trucks to make sure no stolen merchandise is being carried off in them. They are trained to observe anything which may indicate a means by which theft or pilferage is possible."

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Surveillance is not confined to the pier entrance. There are guards wherever cargo is being handled on the pier itself. They are also stationed in the holds of ships when cargo is being worked.

Other services performed include protecting money for wages at piers, supplying guards for armed cars, and the loading of valuable cargo, and co-operation with the U.S. Immigration Bureau by keeping a watch over persons ordered to be detained or deported.

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The Maintenance of British Canals

Problems of Dredging and Mining Subsidence in the Midlands

One of the urgent problems that confronted the Docks and Inland Waterways Executive when they became responsible for practically all the country's inland waterways following the Transport Act of 1947 was the question of their maintenance. Heavy arrears, particularly of dredging, had accumulated before and during the war years. If the waterways system was to be made capable of carrying more traffic, or even of holding what it already had, a general improvement in the standard of dredging was essential, especially in sections where craft could not be loaded to their full capacity owing to the depth of water being reduced through siltation. In those areas where traffic prospects warranted the expenditure, therefore, a large scale programme was initiated to assist navigability by removing impediments, improving depths and channels, and thus enabling craft to carry larger cargoes. Special attention was devoted to the intricate system of canals in the Midlands, where no major dredging had been done for some 30 years. An intensive programme was put in hand, particularly such main routes as Birmingham to Wolverhampton and from Birmingham and Wolverhampton to the Cannock Chase coalfields. In little more than two yearsfrom April 1949 to June 1951—drag-line machines have removed over 767,000 tons of spoil, and approximately 50 miles of waterway have been thoroughly dredged and cleansed. At peak periods a single machine accounted for 900 tons a week.

The concentrated and highly-industrialised nature of Birmingham and the Black Country restricts road access to the canals, and there is a further complication in disposing of the spoil. Tips, mainly marl holes, were obtained, however, in suitable areas, and with the co-operation of industrialists and landowners roadways were improvised to afford access both to the tips and to the canal so that lorries could collect and transfer the dredged material conveni-Where possible the unloading and discharging of the dredgings was mechanised.

As many as 14 drag-line machines have been employed simultaneously, usually working under water, although in some sections the canal was drained first. The machines were operated from either the towing path or offside of the canal, and they dredged to an average depth of 5-ft., with a bottom width averaging 18-ft. Particular care was necessary to avoid damage to the fabric of the canal, weakening of its supporting walls or disturbing any culverts beneath it. Mats were used to spread the load of the machines.

As it was not always practicable to work from the land a Priestman "Cub" excavator mounted on a suitably-adapted narrow boat was employed experimentally as a floating grab. This experiment proved



Grab crane carrying out dredging in the Birmingham area.

most successful, and at times the plant achieved an output of 600 tons per week.

Apart from ordinary silt, in a number of sections the drag-line machines had to cope with an accumulation of household and other rubbish, such as old bedstead frames, bicycles, tyres, dustbins, saucepans, old drums, bricks and concrete. Much weed growth, which had often entangled the propellers of mechanically-propelled craft, was also encountered, but by attacking the roots, dredging has effectively removed this impediment.

Not only has the work given the canals a thorough cleansing and restored a good navigable channel, enabling craft to carry increased traffic, but the greater depth has effected a useful economy by increasing the water storage capacity. The conservation water storage capacity. of water presents a problem in the Midlands, where, because of the relatively high level of the Birmingham canals, considerable expense is entailed in pumping water from the mines to the top levels for circulation. In this connection, the opportunity was taken to cleanse the main feeders to and from Rotton Park Reservoir, Edgbaston, which are extensively culverted underground.

While this work was in progress normal dredging was being carried out continuously by hand-spoon dredgers, assisted by a mechanical floating grab. These operations were confined mainly to reconditioning wharves, bridge holes, ponds in various locks and to points not accessible to draglines. A special craft is employed for work in tunnels and similarly confined spaces in the Midlands.

A supplementary programme involving the use of drag-lines and the Executive's steam grab dredger has also been undertaken on the Stratford-on-Avon Canal between the junction with the Worcester and Birmingham Canal at King's Norton and the junction with the old Grand Union at Lapworth, a distance of approximately 12 miles. This section provides a useful alternative route, with fewer locks, into Birmingham and the Black Country. Some difficulty was experienced in finding suitable tips, but it was overcome with the cooperation of farmers, either by dumping direct on to land adjacent to the canal, or by emptying the dredgings into canalside trenches, from which the earth had first been excavated and deposited on the land.

Mining Subsidence.

Another serious problem affecting maintenance of inland waterways is subsidence caused by mining. Through roads may be allowed to sink with the surrounding country, waterways cannot, and heavy expenditure is entailed in maintaining canals at original levels by building up embankments, adjusting bridge levels, etc. Particular vigilance is essential, therefore, along the waterways passing through mining territories and liaison is maintained between the Docks and Inland Waterways Executive and the National Coal Board on the general problem as well as on any new mining projects that may affect waterways.

There are deposits of coal under the whole of the Birmingham Canal system. and certain sections of canal have been affected by mining subsidence for over 50 years. The amount of subsidence, which in some cases has been as much as 30 feet, depends mainly on the thickness of the coal seam, its depth beneath the canal, the direction and method of working and the nature of the strata. It occurs in "direct settlement," when the workings are immediately below the canal, and by "lateral pull " when they are a short distance from the canal.

Because of the "long-face" or "panel" workings and the extensive use of mechanical



Fractured head-wall of the weir race at Kings-wood; an example of the damage caused by mining subsidence.

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Maintenance of British Canals_continued

coal-cutting equipment today, subsidence is taking place much faster than formerly. A subsidence of 4 feet has occurred recently between Sylvesters and Kingswood Bridges on the Cannock Extension Canal over the Cannock Chase coalfields. It results from coal workings in a 5-ft. seam 123 yards below the surface, directly under and running parallel to the canal. The "panel" method is being used on a coal face of about 470 feet.

To effect reinstatement the puddle and waterway walls and the banks are being raised and strengthened, and it has also been necessary to fill the bed of the canal and to reconstruct a 150-ft. overflow weir from the canal. A cattle arch supporting the canal, which had been badly fractured, has been repaired and strengthened by the insertion of steel centres.

The banks are being treated by back filling with burnt pit metal, locally known as "red ash," and if, with the help of motor lorries, this is consolidated and bottom filled, a substantial embankment is ensured.

Clay for the puddle walls is loaded at a

clay mound by a mechanical digger into jubilee wagons for subsequent transfer to boats, which take it to sites affected by subsidence. Waterway walls are being raised in brickwork. A clayey material discharged direct from boats, mechanically or by hand, acts as a filling for the bed of the canal.

Sometimes the headway of the bridges has to be reinstated. In the case of stone or brick arch bridges, several of these have been replaced by steel or wooden beams that can be jacked up as further subsidence occurs.

Mechanisation at Ports

Continued Increase in Cargo Handling Facilities

Reports which we have published from time to time, from many ports in various parts of the world, are indicative of continued efforts to secure a quicker turn-round of ships in port. Apart from restoration of war damage by modernised quays and sheds, and the smoothing away of labour difficulties, the principle line of approach has been to effect efficient and expeditious handling of cargo by increased use of and improvement of mechanical aids.

Below are given some details of what is being accomplished in this respect at the Clyde and Tyne Docks and at Southampton.

Clyde Docks

The Clyde docks like most other ports had already adopted a certain amount of mechanical handling plant previous to the outbreak of the second world war. During the war and since, the trend has been intensified, encouraged by the need for speedier turn-round of vessels. Today, though still on a limited basis, mechanisation is making a notable contribution to successful operation on the river.

The extent of mechanical handling varies from dock to dock and is largely the responsibility of the stevedoring companies and shipping lines. Major installations and facilities are provided by the Clyde Navigation Trust which has given every assistance and encouragement to the companies concerned.

One of the most interesting and efficient systems is that which is operated at the King George V Dock where co-ordination of mobile and handling units with the existing dock installations is both highly efficient and extremely well organised.

The system in use is the co-ordination of two-ton electric trucks with two-ton and six-ton mobile cranes. When handling suitable goods, gang volume has been increased from an average of 5 tons per hour to somewhere between 11.5 tons to 12.5 tons per hour.

There are 55 two-ton electric trucks in use at this particular dock; although designed to take a two-ton load they do handle heavier tonnages as necessity demands. Working with these trucks are 22 mobile two-ton and six-ton Ransome and Rapier cranes and two Neal slewing cranes.

The mobility and versatility of such units allows the handling of virtually every type of cargo within their scope. Normal routine is that the mobile cranes are used to load the trucks, which shuttle from the sheds to the quayside, or alternatively, to lift from the loaded trucks to lorries or other vehicles, or to the quay sheds. The cranes may also serve as quayside auxiliaries to lift loads which would otherwise involve slow and difficult manhandling. A typical example will suffice to demonstrate this function. Heavy pipes are brought to the quay by rail. To arrange slings by hand would involve heavy lifts and a larger working gang. The mobile crane is used here to "nibble" the pipe end up far enough to allow the slings to be arranged properly.

There has been a very general tendency in industry to find a suitable type of unit and to then standardise on that type, a policy adopted at Glasgow by the makers of the trucks and cranes and which had been proved highly successful. Among the advantages arising are these: varieties of spares are cut to a minimum, while maintenance is simplified; batteries and components are inter-

changeable limiting capital outlay; partly skilled labour can be used because of the standardisation and simplicity of the units involved.

Much of the success of these units and of the system arises from simplicity of controls and ease in handling; these permit even in inexperienced worker to operate the unit after only a few lessors, a most important aspect when men are also mobile and are equired to work in whichever dock their firm has an interest.

It is obviously equally vital that the vehicles should be sturey, since the work is severe, varied and continuous. The fact that trucks have been working for years without serious mishap is p rhaps the best testimonal to the vehicles in use at this dock. Despite really heavy loads, platforms suffer little. Tyres are most vulnerable, but a policy of replacement operates here, so that even if a truck should suffer a tyre defect the component can be replaced and the truck put back to work in a very short time. Battery life is some 16 hours. At the end of that time they are lifted out by mobile crane and carried to the charging section located in one of the quaysheds. The crane lifts a recharged battery, carries it to the truck, and both are ready for immediate At Shieldhall, mobile charging plants are operated to service the charging sections. Each of the two charging sections has always twelve complete batteries on charge to allow continuous operation and exchange of spent batteries, but to further stabilise this system, a new permanent quayside charging station is now being erected to replace the mobile charging plants.

The fleet is serviced regularly by a maintenance staff; use being made of slack spells to do this work, since pressure varies considerably and maintenance must fit in with the run of work.

The mobile cranes have proved themselves for dock work, those in use being sturdy, mobile and simple, all factors which make them ideal for the type of work involved. Maximum value of both trucks and cranes is achieved by the perfect co-ordination of their functions and it is the experience in this case that there are few jobs outside their scope.

Employee reaction is completely favourable. Dockers are the most realistic critics of their equipment and have come to insist on maximum efficiency in equipment if only because it affects their own earning capacities. Bonus earnings derive largely from maximum use of really efficient equipment and there is ample evidence of fullest support for mechanisation in this area.

The position now reached on the Clyde might be summarised thus: dock mechanisation is accepted and is regarded as capable of considerable expansion; the leading concerns have adopted such equipment and are steadily expanding methods and plant with the full support of the Dock Authority; labour involved has also accepted the fact of mechanised handling because of its value in increasing their handling capacity and consequently their earnings; turn-round has improved considerably as a result, to the immense advantage of all concerned.

The prospect now offered is that increased use of mechanisation will become general and that within that policy firms will adopt their own systems of operation and their own type of standard equipment to meet the particular needs involved.

Southampton

The two-ton electric truck for conveying cargo and baggage on lifting trays was a familiar sight at Southampton for some years before the last war. During the hostilities, most of the 60 or so

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Mechanisation at Ports-continued

employed there, were transferred to less vulnerable ports and the majority were afterwards returned. Today there are over 100 of this type of truck in daily use, and recently, orders have been placed with Greenwood and Batley of Leeds who have developed a special truck to suit the requirements at Southampton, with dimensions and controls similar to those of the older trucks. These trucks are capable of travelling with a full load at a speed of four miles per hour and can manœuvre within a radius of 9 feet. A new type of welded tubular steel stillage, or cargo tray has been evolved for the conveyance of cargo by these electric elevating platform trucks which stand up to the work better than the old wooden trays.

Electric "fork lift" trucks capable of lifting loads of 6,000

Electric "fork lift" trucks capable of lifting loads of 6,000 pounds to a height of 8 feet above ground level have recently been brought into service and are proving a valuable asset, particularly where stacking of cargo is required. They are provided with a tilting device which ensures safe conditions when large packages are being transported or lifted.

The moving of railway wagons, gangways, baggage conveyors and other appliances is often performed by electric tractors, known more familiarly as "bumpers." Capable of a maximum momentary effort of 3,000 lb. and a normal pull or push of 600 lb., their mobility and compactness of design enables them to apply their "weight" in any position where an extra effort is required. Ten of these machines are in service in the docks.

Flectric trucks, fork trucks and tractors are all battery operated, and at the end of the working period return to charging and maintenance garages where special equipment enables the batteries to be charged together in groups, and maintenance staff carry out examination and necessary adjustments. The choice of battery operated electric vehicles was made in preference to the petrol or oil engine-driven type on the grounds of reduced fire risk, absence of fumes and less wear and tear. In regard to the latter, it is of interest that some of the very early electric trucks, purchased over 30 years ago, are still in daily use.

Special Conveyors. At the Ocean Terminal for dealing with passengers' luggage, connecting the two Customs halls with the ground floor, are four inclined reversible baggage conveyors—two in the first-class hall and two in the cabin class. These conveyors are of the wooden slat type, inclined at an angle of about 30 degrees and running at a speed of 70-ft. per minute. They are controlled by means of remote push-button switches, operating a reversible air-break contactor panel, and at each end of the conveyor, mounted on the floor, are skid plates for facilitating the movement of heavy baggage.

Mobile ship-to-shore baggage conveyors have recently been added to the list of appliances, and one of these, 61-ft. in length, obtained primarily for use with the liner United States, presented a problem in manceuvrability, particularly at the Ocean Terminal where the quay width is 35-ft. The difficulty was overcome by the provision of a four-wheeled carriage with a turntable platform fixed to the forward end of the conveyor when travelling and removed before the conveyor is placed into position on the ship. The belt of this conveyor, electrically driven and capable of travelling at 80-ft. per minute, can transport nearly three tons of baggage per minute.

For dealing with ships' baggage and stores, when the sill of the door in the ship's plating may be as much as 0 feet below quay level a "hump backed" type of conveyor has recently been brought into use. This conveyor is 45-ft. long, and its speed and carrying capacity are the same as the 61-ft. straight conveyor.

Mobile Cranes. Four petrol-driven mobile cranes, a post-war development, are in use for loading and unloading heavier packages to and from railway trucks and lorries in and about the sheds and quays. Their capacity is 1½ tons at 17 feet radius. 3½ tons at 7 feet and 5 tons at 5½ feet radius. Their mobility makes them a most useful appliance.

Some of the earliest electrically-operated mechanical appliances used at Southamoton docks are the four overhead gantry cranes running through sheds 35-36. Situated on the upper floor over the gullet and running at 200-ft. per minute along overhead rails, these cranes, by means of a travelling cross carriage, transfer loads up to one ton between the two floors or to railway truck as

required. The operator travels with the crane in an underslung control carriage. Equipment for similar duties will be installed in the new Terminal at 102 Berth, New Docks.

All these mechanical-handling appliances are maintained by the Southampton Docks mechanical and electrical engineer's department and, with the exception of the mobile cranes, are manned by staff from the outdoor superintendent's department of the docks executive.

Tyne Docks

Developments on the Tyne, now being sponsored by the Tyne Improvement Commission will, it is hoped, ensure a growing trade for the Tyne Docks. The new facilities, including a new ore quay west of Tyne Dock and modern coal staiths on the north side of the river will ensure the speedier turn-round of ships.

Constructed to meet the growing needs of the Consett Iron Company, the new ore quay is 860 feet long and will be the most modern ore discharging centre in the country when it is completed within the next 12 months. It will be capable of handling 1,000,000 tons of iron ore imports yearly. The ore will be taken from the ships by grabs and conveyors will carry it to 200 feet high bunkers where it will pass down into wagons below for transport by rail to Consett in north-west Durham.

The new coal staiths now under construction opposite the Sutherland Quay on the north side, will make provision for the changing type of coal exports, as more washed coal than ever before is being handled.

The Tyne, as with most other ports, has had to consider facilities for the increasing size of ships. One official of the commission expressed the opinion that the developments at Jarrow Staiths, with those at several quays, had been brought to within the next 10 or 20 years.

There is also on the Tyne a new 25-acre timber yard at East Jarrow, which in six months has handled 46,000 tons of pitprops. It is the largest pitprop yard in the country and the best laid out. Methods of handling the timber are among the speediest, the props being swung out of the ship in slings, which are picked up by an eleteric crane and swung into storage piles. The turn-round of ships is in days, against weeks formerly, and with appreciably fewer men engaged.

These developments, in the opinion of the commissioners and Jarrow Industries' Committee, present a new trading future for the Tyne.

Radar at Sea

"The Use of Radar at Sea." 280 pp. and illustrations. Published by Hollis & Carter, Ltd., 25, Ashley Place, London. Price 30s. This new handbook, issued by the Institute of Navigation, has been compiled by 13 different authors, all of whom are experts in their own particular sphere of radar development or operation. The subject is opened, for those who have little or no previous knowledge of electronics, with an elementary description of the principles of echo-ranging and of the general characteristics of radar. These statements are then enlarged in terms of existing equipment, the emphasis being placed on the functions rather than on the precise composition of the various units. The book then deals, in terms that are simply understood, with the behaviour of radio waves and the response of targets.

The operational aspects of marine radar are covered in a section which describes in detail methods of using radar as an aid to navigation and as a collision-warning set, and which deals exhaustively with the interpretation of the display. The subject of radar and the rule of the road at sea is then dealt with in a chapter which has had the official sanction of the Ministry of Transport, and is indeed the first interpretation of this controversial subject to have had this sanction.

The book deals in detail with special devices to improve radar response and to facilitate identification, and with certain particular uses of radar, both at sea and on shore. Log-keeping, radar maintenance and radar efficiency are also dealt with and the concluding chapters discuss possible future developments.

Eastham Oil Dock

Technical Details of New Works

By Mr. D. C. MILNE, B.Sc., M.I.C.E. Chief Engineer, Manchester Ship Canal Company.

The new Oil Dock, which is at present under construction for the Manchester Ship Canal Company, will provide accommodation for four of the largest type of tankers. The area of the dock is approximately 18 acres and the depth of water is 40-ft. The total cost of the scheme will amount to approximately £5½ million.

The oil will be pumped from the ship to large balancing tanks situated in a tank farm about one mile upstream from the dock. From the tank farm the oil will be pumped a distance of six miles through a 16-in. diameter pipeline laid along the bank of the canal to a refinery which is located at Stanlow.

Approach Channel.

It has been necessary to carry out extensive dredging in the River Mersey to improve the approach channel to the new dock. The channel across Bromborough Bar will be widened to 500-ft. and deepened to 17-ft. below L.W.O.S.T. The approach channel to the new lock is being deepened to 20-ft. below L.W.O.S.T. and this latter work has involved the removal of approximately 100,000 cu. yds. of rock. The method used was to cut the rock by means of Lobnitz rockcutters which so completely pulverised the material that its subsequent removal by bucket dredger has presented no difficulty.

When the dredging of the new channel is completed, it will provide a depth on Bromborough Bar of 43-ft. at H.W.O.S.T. and in the approach channel to the new lock the depth will be 46-ft. at H.W.O.S.T.

Lock and Entrance Wall.

The lock is 807-ft, long and 100-ft, wide and it will accommodate a large tanker with its attendant tugs. The entrance wall is 730-ft, in length.

In order to construct the entrance wall and the outer end of the lock, a cofferdam was constructed enclosing this part of the work. The cofferdam was of the rock fill type with a steel sheet pile cut-off.

A short secondary dam (No. 2) of similar design was constructed between cofferdam No. 1 and the existing river bank. This enabled the contruction of the lock entrance to proceed simultaneously with the extension of cofferdam No. 1, upon completion of which the secondary dam was removed. To enable the main cofferdam to be breached and the lower gate to be floated into position a third cofferdam (No. 3) was placed between the lower and intermediate gate cambers at a later stage in the work. This dam consisted of No. 5 Larssen steel sheet piling carried on mass concrete arched ribs, the lock walls being strengthened at the springing points to take the re-action from the dam. The total load on the arched dam at H.W.O.S.T. was about 4,000 tons.

The entrance wall and the lock walls are of the gravity type and are constructed in mass concrete. In both cases, the foundation consists of red sandstone, and this material formed about 50 per cent. of the excavation, which amounted to 960,000 cu. yds.

The total quantity of concrete in the entrance wall and lock amounts to 225,000 cu. yds. and the whole of the concrete work was carried out from a mixing plant located between the lower and intermediate gate cambers. The concreting plant consists of two 2-cu. yd. mixers which are connected to four 6-in. diameter concrete pumps which deliver material to the various parts of the walls at the rate of 50 cu. yds. per hour.

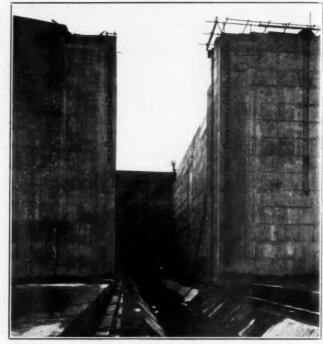
The lock walls are 67-ft. in height and 33-ft. 6-in. wide at the base. The depth of water on the sill is 48-ft. at H.W.O.S.T. The invert of the lock and the floors of the three gate cambers are covered with concrete to prevent scour of the soft red sandstone which forms the bottom of the lock. A sectional type of dam has been provided which will enable each camber to be dewatered as required and the intermediate camber has been enlarged to

enable it to be used as a dry dock for carrying out maintenance repairs on the gates. The lock sills and quoins are of granite, tinished to a smooth surface to provide a watertight joint with the greenheart sealing timbers on the gates.

Three gates of the sliding caisson type are provided and are all interchangeable. They are operated by electric winches located at the end of each camber, but in the event of current failure the gates can be operated by hydraulic power.

The gates, 106-ft. long, 23-ft. wide over the sealing timbers, and 57-ft. high, weigh 1,860 tons each, including ballast, and slide on cast steel paths. The ballast and trimming tanks are equipped with electric pumps so that the buoyancy can be adjusted as required to give a preponderance of between 10-90 tons under working conditions.

The main culverts used for raising and lowering the lock are 13-ft. in height by 6-ft. 6-in. in width and run the full length of



View of lower gate cill and camber, 19/3/52.

the lock walls. In the design of the culvert openings, experiments were carried out at Manchester University to determine the size and spacing of the openings which would produce the minimum of turbulence in the lock, and ensure a uniform distribution of the siltation over the lock floor. The River Mersey is heavily charged with silt which finds its way into the lock through the sluices, and in the existing locks at Eastham banks of silt form between each pair of sluice openings, requiring periodical dredging.

The sluice paddles are built of greenheart timber and are operated by hydraulic power supplied through high pressure mains from the power house. The paddles slide on polished granite faces and can be used for a head on either side. Each paddle assembly weighs about 9 tons.

Dock

In the design of the dock, the leading dimensions were determined by the diameter of the turning circle required to swing the largest tanker with three berths occupied. A turning circle of 735-ft. diameter has been provided, and the berths vary in length from 730-ft. to 900-ft. At the north-east corner provision has been made to construct a link from the new dock to the ship canal at some future date.

Owing to unsatisfactory site conditions, it was necessary to provide continuous quay walls to the dock perimeter and after an extensive investigation of the problem, during which several different designs were considered, it was finally decided to adopt ce

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Eastham Oil Dock_continued

mass concrete gravity walls. The walls are 56½-ft, in height and 30-ft, at the widest part.

The concreting of the dock walls will be carried out from the central mixing plant located between the lower and intermediate gate cambers. The distance of the dock from the concreting plant was too great to enable pumps to be used. It was, therefore, decided to transport the concrete from the mixing plant to the dock walls by means of conveyor belt, large sections of which became available as the excavation areas were completed. For this purpose the belt was entirely enclosed to protect the concrete from the weather. The speed of the belt is 280-ft. per minute and the time required to carry the concrete from the mixing plant to the farthest point of the dock wall will be twelve minutes. Tests made on samples taken from the dock walls have given a compressive strength of over 2,000 lbs. per sq. in. at seven days. The mix used is 1-3-6 and all concrete is vibrated.

Each berth will be equipped with 8 bollards capable of taking a pull of 100 tons. At the middle of each berth, cranes will be provided for handling the flexible pipes which will connect the

tanker to the shore pipelines.

In the excavation of the dock, 2,300,000 cu. yds. of material will be removed. Approximately half of this quantity will consist of red sandstone which also forms the foundation of the walls. The spoil is deposited on deposit sites which are located near the dock, and the entire excavation has been handled by conveyor belts. Draglines load the material into hoppers which discharge on to the conveyor belts which are capable of transporting up to 600 cu. yds per hour per belt.

Power House.

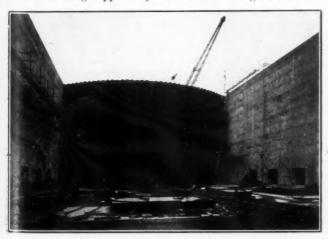
The power house which formerly supplied the hydraulic power for operating the gates and sluices of the existing Eastham Locks had to be demolished as it occupied the site of the upper gate camber of the proposed lock.

A new power house has been constructed and is now supplying the hydraulic power for the existing locks. The main building of the power house is a steel-framed structure 122-ft. by 46-ft. and there are various small ancillary buildings comprising office, mess room, E.H.V. switch rooms, transformer house, stores and two elevated reinforced concrete water tanks.

The larger of the two tanks is a settling tank for canal water which is used in the hydraulic power system of the locks and the smaller tank contains mains water used in the cooling water system of the diesel engines.

A suction well at the east end of the power house is connected to the ship canal by a 42-in. diameter tunnel. Canal water is pumped from the suction well into the settling tank by two electrically-driven 25 B.H.P. pumps, float controlled from the draw-off chamber of the tank.

In the event of a power failure there are two $7\frac{1}{2}$ B.H.P. pumps, the current being supplied by two diesel-driven generators.



View of arched dam from lock gate cill, 14/3/52.



View from upper end of lock, 14/3/52

Two electrically-driven pumps will supply the hydraulic pressure to operate the existing locks and the sluices of the new lock. These pumps are 280 B.H.P. and are automatically controlled from the accumulator. The capacity of each pump is 20,000 gallons per hour at a pressure of 750 lb./sq. in.

A standby plant is also provided. This was transferred from the old power house and consists of three 184 B.H.P. diesel engines, each driving a pressure pump with a delivery of 12,000 gallons per minute at a pressure of 750 lb./sq. in.

The water for fire-fighting will be pumped from the suction well by means of two electrically-driven two-stage pumps in the power house, each capable of pumping 1,000 gallons per minute at 180 lb./sq. in.

The group of buildings which comprise the power house are designed to allow for future development in the area.

Buildings.

new lock.

The main administration block is located adjacent to the lock, and, in addition to the company's staff, will provide accommodation for pilots and helmsmen, offices for the oil companies and other firms connected with the undertaking; a staff canteen and a smokeroom and galley for the crews of the tankers, and a second smokeroom and galley will be provided at the dock side.

Ancillary buildings in the vicinity of the dock will include shelters for berth attendants and stores for flexible pipes and other equipment.

An office and control tower with a commanding view of the river, canal and dock will be built for the harbour master, and a maintenance workshop is to be sited near the river wall of the

Fire-Fighting Appliances.

For fire-fighting appliances, a 12-in. diameter ring main will be provided round the dock perimeter and equipped with numerous hydrants. Water will be delivered at high pressure to the main by the electric pumps located in the power house and portable foam equipment will be available at all berths.

Repairs to Gourock Pier.

British Railways (Scottish Region) announce that the repairs to the main structure of Gourock Pier, which started in the early spring of this year, are proceeding steadily, but a good deal of work still remains to be completed and it will be some months before the entire overhaul is completed. Because of heavy traffic in connection with shipping lying at the Clyde anchorage during the war the pier, which is about 1,500-ft. long, was subjected to abnormal usage, and dredging work was carried out at the eastern end so that destroyers and other naval vessels of similar draught could be accommodated there. Extensive repairs were carried out by contract between 1947 and 1948 and the present repair contract is proceeding in organised stages so that there is the minimum of interference with the berthing of the Clyde river steamers, and the general conduct of the pier traffic.

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Port Economics

Part 11. Inland Water Transport

By A. H. J. Bown, O.B.E., F.C.I.S., M.Inst.T. General Manager and Clerk, River Wear Commissioners, and General Manager, Sunderland Corporation Quay.

O conclude the present study, the author has been requested to provide a few notes relating to the economics of canals and navigations, their special relation with ports and their economic advantages and limitations. A large part of this ground was covered in Chapter XI of the companion volume, "Port Operation and Administration" (Chapman and Hall), pages 262 to 279, to which the reader is referred. The following paragraphs may serve to supplement the information there given.

The Track and the Carrier

Perhaps the first point of interest to the transport economist is that, in the matter of the inland waterways of Great Britain, the two functions of providing the track and carrying the traffic are very largely divorced. Since the passing of the Transport Act, 1947, practically all the canals have passed into the hands of the British Transport Commission. They maintain a total of about 1,766 miles of inland waterway in use and they also have about 350 miles closed to navigation. The Commission acquired these waterways partly from the old railway companies and partly from 18 non-railway waterway authorities. On the other hand, fourfifths of the carrying on Transport Commission waterways is done by private firms and only one-fifth by the Transport Commission. These arrangements provide a contrast with the railway organisation where the Transport Commission provides all the track and does all the carrying. The situation in road transport is different again: the track is provided partly by the State, partly by county councils and partly by other local authorities, whilst some of the carrying is done by the Transport Commission, some by haulage firms, some by passenger-carrying organisations, and some by traders transporting their own goods-with the private citizen also at liberty to move about amongst them as best he may. It is, of course, frequently contended that most users of the highways contribute largely to track upkeep through taxation levied on vehicles and fuel, whilst the ratepayer also adds his quota.

Traffic Statistics

In considering these matters, it may be a help to students to have some of the principal facts and figures before them. The following are taken from Whitaker's Almanack 1952 and from the British Transport Commission's Report for the year 1951. On the 1st January, 1948, the Docks and Inland Waterways Executive of the British Transport Commission took over about 2,050 miles of the system and organised them into four divisions, exclusive of Scotland, each of which is based on a major river estuary. These divisions have headquarters at Leeds. Liverpool, Watford and Gloucester. The Commission is charged with the duty of providing or promoting the provision of an efficient, adequate, economical and properly integrated system of public inland transport. In recent years, the tonnage of traffic carried on the waterways of the Transport Commission has been as under:—

Coal and other fuel		1948 Tons 5,537,000	1949 Tons 5,566,000	1950 Tons 5,791,000	1951 Tons 5,844,000
Liquids in bulk		1,758,000	1,745,000	1,835,000	2,036,000
General merchandise	***	4,015,000	4,015,000	4,176,000	4,356,000
Totals		11,310,000	11,326,000	11,802,000	12,236,000

The following details relate to the divisions of the Transport Commission's organisation:—

ission's organisatio	n:—	Miles	Tonnage carried	
Waterways N.E. division		 in use	1950 4,932,000	
N.W. division	***	 476	1,621,000	
S.E. division		 419	3,295,000	
S.W. division		 386	1,851,000	
Scottish canals	***	 139	103,000	
		1,766 miles	11,802,000 tons	

The more important of the waterways excluded from these arrangements are as follows:—

	Miles	Tonna	ge carried
Waterways	in use	1949	1950
Bridgewater	40	760,435	763,680
Manchester Ship	36	8,889,677	9,749,962
Thames Conservan	ancy 136	290,948	397,250
	212 miles	9,941,060	10,908,892 ton

Alongside the 1951 total of 12,236,000 tons traffic carried on Transport Commission canals, it may be useful to have in mind the 1888 total U.K. figure of 35,301,857 tons (estimated — and probably not very accurately) and to remember that the Manchester Ship Canal was not opened for traffic until 1894.

Finance

Against the above-given totals of mileage maintained and traffic carried, it will be valuable for the reader to consider now the latest published financial results of the Transport Commission's operations. They are as set out below:—

I.—Inland Waterways—Other Than Carrying Operations, Working Results.

Working Results.		
Gross receipts	1950 £	1951 £
Tolls and dues 86		
****		898,572
		123,370
		657,296
Miscellaneous 8	6,740	81,797
£1,58	9,834 £1,	761,035
Working expenses (including depreciation or	1950	195
renewals but after deducting abnormal maintenance)	£	£
Wages and national insurance con- tributions of toll clerks, book-		
1	909 =1=	990 *=0
Maintenance of canals, structures,	303,715	320,772
	1 022 001	
plant and equipment	1,375,601	1,511,428
Depreciation of plant and equipment	30,031	32,878
Water supply	29,998	26,931
Compensation for damage or loss of	20.00	
goods, property, etc	3,640	32,872
General charges	50,478	45,538
Administration	143,956	166,834
Publicity	937	1,700
Local rates	52,633	54,716
Miscellaneous expenses	128,635	140,733
D. L.	2,119,624	2,334,402
Deduct abnormal maintenance		
(charged to Abnormal Maintenance		
Account)	375,661	386,915
	£1,743,963	£1,947,487
Deficit	£154,129	£186,452

II.—Inland Waterways—Carrying Operations, Working Results.

Gross receipts	1950 £	1951 £
Freight, water conveyance	666,114	776,542
Freight, road conveyance	15,857	21,452
Miscellaneous	11,667	8,940
	£693,638	£806,934
Working expenses (including depreciation or renewals but after deducting abnormal	1950	1951 £
maintenance)		
Operation of craft and road vehicles Maintenance of craft and road	265,217	263,699
vehicles	172,641	188,040
Depreciation of craft and road	112,021	100,010
vehicles	15,198	15,679
Compensation and insurances for	201200	*********
damage or loss of goods, property,		
etc	5,168	4,990
Inland waterway tolls	144,141	165,030
General Charges	7,611	6,995
Administration	58,006	68,156
Payments to sub-contractors for	00,000	00,200
carrying services	109,164	125,951
Publicity	399	684
Local rates	664	71
Miscellaneous expenses	43,371	91,201
	821,580	930,496

Port Economics-continued

Dedu of (ch		and	road	nainter 1 vel Mainter	nicles		
	ount)	***	***	***	***	34,147	35,282
						£787,433	£895,214
Deficit			***		***	£93,795	£88,280

It will be seen that in the latest recorded year, and taking the two spheres of activity together, there was a combined working deficiency of £274,732, but only after making all prudent working charges, such as depreciation or renewals. It should be noted that the charges shown in Statement II above for inland waterway tolls are nearly all included per contra in the gross receipts shown in Statement I. The resulting net deficiency, however, is before charging certain central charges (mainly interest) which are met out of the combined net receipts of the Commission. As against this, the following total figures were published some years ago, purporting to show income and expenditure in the year 1905 relative to all British canals of commercial importance. The make-up of these figures is not now available and they cannot be used for any purposes of comparison. They may serve, however, to show the rough relation of expenditure to income 47 years ago.

Revenue				£	
From tolls			***	850,582	
From freight as ca		***	***	826,115	
From other sources	(e.g.)	wareho	using		
and rent)			***	404,855	
					£2,081,552
Expenditure					
As canal owners	***	***	***	919,103	
As carriers	***	***	***	652,157	
					1,571,260
Surplus revenue			***		£510.292
Darpius Tevenue					

The Special Economic Problems

The economist of 1952, looking at the inland waterways of this country, needs especially to remember the mood and temper of the age in which they were laid down and to consider also the major developments in transport and in industry which followed so swiftly upon the heyday of the canals. The first canals were hailed as the perfect answer to the vast new transport demand which was generated by the industrial revolution. The new machines and the first factories were hungry for raw materials and for fuel and were badly in need of a cheap and reliable service for despatching their finished products. In addition, citizens of the new manufacturing age, emerging from the pastoral and village-craft life of their fathers, demanded more consumption goods than ever before. The promoters of the early canals met the new need and in consequence the number of canal projects multiplied rapidly in an atmosphere of haste and public excitement. The inevitable result was that some of the schemes were insufficiently considered, some designs could have been better, rivalries and jealousies abounded, money sometimes ran short and some projects were never properly finished. The mark of that time lies on the canals to-day. railway builders and the new road-makers, who followed the canalcutters in that order, knew some of the mistakes to avoid. canals had no national gauge, involving much costly and tedious transhipment: a national rate-book was impossible, time-tables were not practicable and each season of the year brought its own difficulties-ice and floods in the winter and drought in the summer.

The Position To-day

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The present mileage of usable waterway route is more than adequate to requirements but if there were more craft in service on that mileage the service could be notably increased in efficiency. Before the last war, the outlook for the canal carrier was not particularly attractive and, in consequence, many craft were scrapped and never replaced. The supply of recruits for the industry therefore tailed off, and craft-construction has been further hindered by shortages of materials and labour and by national spending restrictions. The Commission's short-term emphasis is therefore placed upon swift repairs, smart turn-round of craft and the laying-off of out-moded and unwanted sections of waterway. In the long term, the Commission sees the requirements as including (1) more and better craft, (2) more trained crews, (3) better terminals, (4) extension of the compartment or floating container system, and

(5) more tractor towage. On the wide canals, the Commission now have 17 tugs, 57 power-driven craft (capacity 3,825 tons) and 713 dumb craft (capacity 29,325 tons): whilst their narrow canal fleet consists of 2 tugs, 218 power-driven craft (4,915 tons) and 251 dumb craft (capacity 6,323 tons). All the foregoing craft are engaged upon traffic working but there is, in addition, a maintenance fleet consisting of 48 tugs, 93 power-driven craft and 546 dumb craft. As previously indicated, there is about four times as much carrying capacity in independent operation.

The Future

In its fourth annual report, the Transport Commission has made a clear and valuable statement of its views as to the part to be played by inland water transport in the years to come. It is suggested that this mode of carriage is especially suitable for traffic of the following kinds:—

(a) Goods which can be handled overside at ports which connect with the water route

(b) Traffic in complete barge loads

(c) Goods wanted or arising at waterside premises

(d) Bulk liquids

(e) Goods which can be conveniently trunk-hauled to waterhead depots with subsequent delivery by road.

On this basis, it is considered that there is a promising future for the following waterways: Aire and Calder, Sheffield and South Yorkshire, River Trent, River Weaver, River Severn and Gloucester and Berkeley Ship Canal, River Lee and Grand Union.

Besides these principal routes, certain others would be useful supplementaries, namely: Calder and Hebble, Leeds and Liverpool, Shropshire Union (Main Line), Trent and Mersey, Birmingham Canals and some connecting waterways, Coventry Canal, and Oxford Canal (northern section).

A particular point is made of the potential usefulness of some waterways in extending the effectiveness of the coastwise sea route but α is also noted that co-operation with the seaway was adversely affected by the war and has since suffered by reason of the large

increase in coastwise freights.

It is stressed that the Caledonian and Crinan Canals are economically incapable of commercial exploitation. Revenue from traffic cannot meet the costs of maintenance and the position is worsened by the expense of operating and maintaining a number of swing bridges carrying trunk roads. The suggested remedy is that the Minister of Transport should relieve the Transport Commission of this continuing liability.

The above-given three categories of canals may be described as the efficient, the supplementaries and the loss-makers. Beyond these, the Commission is presently responsible for 800 miles of waterway of which 200 miles may possibly have some commercial usefulness but the remaining 600 miles have no further contribution to make to the nation's transport system although they may be useful in supplying water for industrial purposes or in connection with drainage or pleasure boating. The Commission's policy is to dispose of these waterways by negotiations with local authorities, River Boards and others with a view to transfer to those Bodies concerned with their present or potential use.

The Commission summarises its own aim as an attempt to separate the live canals from those which are virtually unused for carrying purposes and by dealing separately with those in the latter category it is hoped that means may be found to reduce the deficit. As previously indicated the 1951 deficit on canal-owning was £186.000 and it is interesting to look at this figure in the light of the following economic analysis:—

- (a) Waterways which carry substantial traffic and would appear to offer scope for commercial development
- to merit retention for transport purposes
 (d) Canals which carry virtually no traffic or
 are already closed to traffic

£ 255,000	£
	46,000
	80,000
	315,000
£255,000	£441,000

Net deficit

£186,000

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Chromium Alloy Steels

Greater Strength and Resistance to Wear

By J. LOMAS.

Manganese steel of austenitic type has certain limitations, and although it is the ideal material where abrasion has to be resisted, it has a tendency to flow sideways under percussion, which causes difficulties in such parts as lining plates, rotating hammers of certain types, suspension hooks, etc. To serve as an alternative in these instances, steel manufacturers have developed a chromium alloy cast steel in a number of different grades, the precise chemical composition being varied to meet the work the castings have to carry out. Much thought has been given to this material to ensure that it conforms to the requirements of the operation.

The castings made from this chromium alloy steel are subjected in the first place to a double and controlled heat treatment, which is designed to put them into the very best physical condition. The steels have carbon contents either 0.5, 0.7 or 0.8% according to the purpose. The first is suitable for wearing parts of machinery; the second is for similar purposes where higher wear resistance and greater toughness are required. The third is for equally high resistance to wear, but where a smaller amount of impact shock is likely to be encountered.

These alloy castings have a high elastic ratio, which means that they do not flow sideways under percussion, and it is in this respect that they may be preferable to austenitic manganese steel, which does so flow in the circumstances already mentioned. For this reason the use of the chromium steel castings involves less expense, as they last longer, while in addition there is the fact that, though not exactly easy to machine, they are much more easily machined than austenitic manganese steel. Consequently, manganese steel has often to be ground to shape where a high degree of accuracy to dimensions is required, and this is an extremely heavy item of production expense. Moreover, easier machinability renders castings of the chromium alloy steels lower in first cost than austenitic manganese steel castings. The cutting speeds for machining these steels are, however, relatively slow.

The high resistance to wear of these castings means that they have a long service life. On average, liners made from them have a Brinell hardness number of 255. In some instances, i.e., where shock is only slight, a still higher figure is obtainable, but is recommended in special instances only. The castings have usually a high degree of homogeneity, and if made by a reputable steel founder, are free from blowholes. This makes an appreciable contribution to the longer service life claimed for this type of casting. The chromium content is usually of the order of I to 2 per cent., and this addition not only gives the castings higher strength, so that a saving in weight can be effected, where required, but it also renders them sensitive to heat treatment, a response which may be further improved, where necessary, by the addition of from 0.25 to 0.5 per cent. of molybdenum.

We may now turn to other types of chromium steels, beginning with the lower carbon-chromium types, containing up to approximately 2.5% of chromium. These steels are harder in the untreated state than plain carbon steels of similar carbon content, and when subjected to heat treatment, have additional hardness and strength conferred upon them. They also have a greater resistance to wear, and are capable of being worked, smithed and cast as readily as the unalloyed carbon steels, for which they are used when additional hardness is called for.

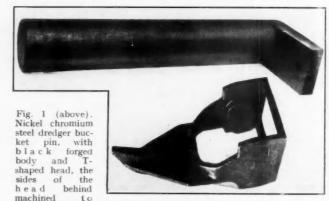
A useful chromium steel is that employed for ball and roller bearings, in dockyard, road-making and other types of machinery. This steel has a composition of which the following is typical: carbon 1.0 to 1.2%, chromium 1.3 to 1.5%, manganese 0.3 to 0.35%, silicon 0.25 to 0.3%. When the ball bearings for which this material is required are less than ½ in. in diameter, the steel is usually given heat treatment, consisting of hardening in water at 750° C., followed by tempering at approximately 200° C., for 30 minutes. Where the diameter of the bearings exceeds ½-in. it is usual to

harden by quenching in water, at a temperature within the range 820 to 840° C., which should give a Vickers diamond hardness number of approximately 800.

Another interesting steel is used for gear wheels, and has the advantage that it can be hardened on the surface by a suitable form of surface-hardening treatment. A typical steel of this class has a composition as follows: carbon 0.6%, silicon 0.3% (maximum), manganese 0.65%, chromium 0.6%. This steel is hardened at 640° C., and tempered at 600° C., which should result in a yield stress of about 40 tons per sq. in. and a tensile strength of about 65 tons per sq. in., with an elongation on 2-in. of at least 15% and reduction of area at least 40%. The Izod impact figure should be in the region of 40 ft. lb., and the Brinell hardness number of the order of 310.

Another useful chromium steel is employed in making roller bearings, cams and camshafts of excavators and other types of earth-moving and road-making machinery. It contains about 1% of chromium together with about 0.5% manganese, and when hardened in water, gives a tensile strength of about 50 tons per sq. in., an elongation of at least 18% in 2-in., with a reduction of area of at least 40%, the Brinell hardness number being in the region of 240.

There is also a considerable employment of chromium alloy stels for parts of dock and other bridges, since these materials offer, as earlier indicated, the opportunity of economising in weight as compared to carbon steels of unalloyed type. One of the most suitable steels for this work contains about 0.3% (maximum) carbon. 0.3% manganese, 1.0% chromium, 0.35% copper, 0.2% silicon (maximum). There are, however, other constructional chromium alloy steels. That already mentioned should provide a tensile strength of about 40 tons per sq. in., with an elongation of 20 per cent in 8-in. and a 40% reduction of area. The addition of a small copper content is designed to give the steel a higher resistance to corrosive attack, either by river or harbour waters or by the atmosphere. Of



gauge. The tensile strength of the pin is 60-70 tons per sq. in. Fig. 2 (below). Chromium alloy steel suspension hook.

the alternative steels, one contains 0.5% chromium, 1.2% manganese, 0.8% silicon, and from 0.1 to 0.6% carbon. Such steel has greater hardness and strength than the constructional unalloyed carbon steels, and should give a tensile strength of the order of 56 tons per sq. in., untreated, and 65 to 70 tons heat-treated. The steel has a high fatigue limit, a reasonable degree of ductility and impact strength.

There are a number of steels containing chromium in combination with percentages of nickel. These are used because they have a sound combination of strength, hardness, ductility and toughness, and when castings are made from them, these will possess comparatively high fatigue resistance and resistance to abrasion. The additional advantage they possess is that their characteristically high ductility is combined with a high yield strength. The normal composition range is from 0.3 to 0.5% carbon, 1.9 to 2.8% nickel, 0.85 to 1.1% chromium, 0.5 to 0.75% manganese, and 0.25 to 0.5% silicon. The majority of the cast parts of this type, such as crane and excavator parts, winch parts, lifting machinery parts, gears, etc.. are given a normalising treatment at approximately 950° C., followed by a quenching in oil at from 850 to 870° C.

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Chromium Alloy Steels_continued

with a later tempering at from 600 to 650° C. This treatment may, however, be modified to suit particular requirements, or the specific function of the casting.

The characteristic mechanical properties of a steel of this type, heat treated as shown above, are roughly as follows: tensile strength after quenching in oil from 870° C. and tempering at 650°/54 tons per sq. in.; yield point/42½ tons per sq. in.; elongation, 15% in 2-in.; reduction of area 32% in 2-in., Brinell hardness number, 248. Higher tensile strength can be obtained by increasing the carbon percentage to 0.5, which also improves the yield strength, but causes a falling off in elongation and reduction of area. Modifications of composition also result in a modification of the mechanical

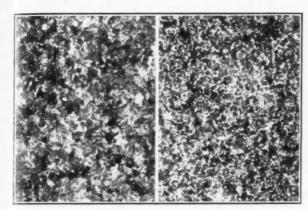


Fig. 3 (left). Chromium alloy steel oil-quenched at 840 deg.
C., tempered at 560 deg.
C. Vickers pyramid hardness 283.
Fig. 4 (right). Chromium alloy steel, normalized 900 deg.
C., tempered 500 deg.
C. Vickers pyramid hardness 247.

properties. These steels are mostly used for cast parts of somewhat heavy cross-sectional area likely to be subjected to severe stresses in service.

Another useful steel contains nickel, chromium and molybdenum. The molybdenum is added with a view to making these steels more capable of hardening in air, and giving them a higher degree of toughness. It is possible to make large castings in this steel by reason of the increase in penetration of hardness rendered possible by the molybdenum addition. The purposes for which this type of steel is used are the same as for the preceding steel. A reasonable measure of strength is also retained at elevated temperatures, while other advantages are resistance to fatigue and abrasion. A reasonable degree of hardness and strength is maintained even at temperatures as high as 540° C., and while the dockyard engineer is not likely to be called upon to deal with problems of such high temperature as this, the effect of heat in hot climatic conditions on dockyard machinery is a factor that has sometimes to be studied.

The usual composition range for this kind of steel is 0.25 to 0.35% carbon, 0.6 to 0.75% manganese, 1.25 to 2.0% nickel, 0.6 to 1.0% chromium, 0.3 to 0.4% molybdenum. Individual steels may exceed these limits slightly according to their manufacturers. The cast parts are usually given a normalising treatment from 970° C., followed by oil quenching from 850 to 870° C., and tempering within the range 600 to 650° C. Some compositions are tempered at lower temperatures than those indicated, but these are not of much importance. A characteristic steel of this type, containing 0.3% carbon, 2.0% nickel, 0.85% chromium, and 0.25% molybdenum, should give mechanical properties in the region of 50 tons per sq. in., tensile strength; 39 tons per sq. in., yield point; 21% elongation in 2-in.; 50% reduction of area; Brinell hardness number 240; after cooling in the air at 875° C., followed by tempering at 650° C.

There are, in addition to the steels already enumerated, a number of highly important chromium alloy steels whose primary purpose is resistance to corrosion. Complete books have been written on these steels, and a wide range of technical literature exists in the form of articles, research studies, etc. It would, therefore, in an article of the present length, be impossible to deal com-

prehensively with any and every composition on the market. For this reason the writer has confined himself to the more clearly defined and most commonly used steels of this type.

The first group contains from 12 to 20% of chromium, with a carbon content ranging from 0.25 to 0.8%. The second group is composed of high chromium, low nickel steels with from 16 to 20% of chromium and 2% nickel, with a carbon content ranging from 0.1 to 0.2%. The third group comprises the austenitic nickel chromium steels, which may or may not contain percentages of tungsten, molybdenum and copper.

Uses for these chromium steels of corrosion-resisting type include parts of dock and harbour machinery liable to corrosive attack. The steels of the first two groups mentioned above can be hardened by heat treatment and are magnetic. The third group cannot be hardened by heat treatment, and are non-magnetic in the softened state. These steels are, however, the most corrosion-resistant, the steels of the first group being the least.

Rising Port Operation Costs in America

Planning and Co-operation Needed

By WILLIAM F. GIESEN General Manager, Maritime Association of the Port of New York,

As we enter into another year of the postwar era and come further along the road from a period of free spending and false prosperity, the time is at hand when all persons interested in port welfare must take stock of the ever spiralling costs of terminal operations. I wish to consider some of the factors in the rising costs of terminal cargo operations, some of the inevitable effects of these rising costs and, in conclusion, of a few suggestions as to how future plans must be made now to cope with this cancerous condition before irreparable harm has been wrought on the great ports of the United States.

A full and complete analysis of costs that make up the charges which inevitably must be passed on to the exporters and importers engaged in world commerce would entail a listing of a myriad of factors, each one of which would undoubtedly be found to have taken a decided upward trend in the postwar years. Upon a close examination of these cost factors, we would find that in many instances the cause of these increases could be accounted for simply by the constantly decreasing value of the dollar. However, this overall inflationary trend is a national problem which at the moment is testing the leaders of our Government and is one which must be dealt with at that level.

Those engaged in port planning and port operations have a very direct responsibility in the problem of rising costs when we find that among the costs which are running rampant on an upward trend are some which far-sightedness and intelligent planning can alleviate. Cost factors within this category fall into two general classifications:

- 1. Terminal overhead expenses; and
- 2. Labour costs.

The factors underlying the first general classification, as I see them, are pier rentals, insurance premiums and congestion. In commenting briefly on each of these factors, I am sure that all persons engaged in port planning have experienced a marked rising in the cost of maintaining a centre of operations. In some ports in the United States, a shipping operator is obliged to lease a terminal, either on a short or a long-term basis. I am advised that an arrangement exists in many ports whereby a docking or wharfage fee is charged for the use of a terminal. In either event we have experienced an upward trend in charges levied for the use of these terminals which is not altogether commensurate with the decreasing dollar value.

The terminal facilities in most of the ports of the United States are in many instances outmoded by the times. A dissipated condi-

^{*}Extracts from Paper read before a panel on Port Development at the 26th annual Propeller Club convention held in Los Angeles.

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Rising Port Operation Costs in America-continued

tion of these facilities and their surroundings leads to two major factors in the cost elements of terminal operation. With the increasing age of piers, insurance rates must necessarily continue upward, and insurance premiums are either calculated in the rentals or wharfage figure, for the use of the piers, or are directly paid by the operators who use the terminals.

Labour Problem

In reflecting upon the part which labour conditions play in the picture of rising costs, I wish to state at the outset that we are not talking here of the right of organised labour to bargain hard for a fair wage, pension, vacation or other fringe provisions, nor for respectable working conditions and hours.

However, there are abuses which form no part of the agreement eventually reached, which lead to increased costs to the ultimate consumer of the services offered by marine transportation.

Before considering some of the abuses that run the cost of cargo handling upward, let us have it clearly understood that no accusation or inference is made that these abuses are in any way sanctioned or endorsed by organised labour. On the contrary, there is little doubt that the leaders of organised labour fully realise that the evils that we are considering are just as bad from their standpoint as from the employer standpoint.

First and foremost among these abuses is the wildcat work stoppage. In this connection, I have frequently heard the figure of \$5,000 a day as a cost item mentioned for each and every day that a wildcat work stoppage takes place on any given pier in the Port of New York.

Secondly, I am sure that every port in the United States, and for that matter in the entire world, suffers the experience of so-called rackets, which include payroll padding, pilferage, work slow-downs and other conditions such as bookmaking, loan-sharking and kickbacks, and other evils that create an environment conducive to a condition of unproductivity, leading to riging costs.

condition of unproductivity, leading to rising costs.

In terms of final results, rising costs stemming from the factors which we have mentioned briefly, lead to certain inevitable consequences. First we have experienced examples of exporters and importers who have reached the saturation point, who find that engaging in their business can no longer be a profitable venture by the time the purchase price of articles has been met and the transportation costs and labour costs have been added thereto. The disappearance or elimination of a business venture by any exporter or importer ultimately results in a loss of cargo for those maintaining the transportation facilities in any given area.

Another feature of the postwar era which must be taken into account as a consequence of rising costs is the increasing production of both manufactured articles and bulk materials produced by nations who were not producing during the war years. The time is upon us when the manufactured articles emanating from Germany and Japan, although sometimes inferior in quality, are replacing the manufactured articles of our country in foreign markets because of the cost advantage to the purchaser in foreign

Air Competition

Last but not least, we must consider the fact that world commerce is no longer entirely dependant upon ocean transportation, which requires the use of port facilities. We are on the threshold of the era of the air. Statistics of the air development division of the Port of New York Authority reflect a constant upward trend in the movement of world commodities via air. An analysis of freight movement via air furnished to me just before leaving New York, by a steamship company serving New York to Cuba, disclosed that cargoes falling into 97 different classifications were transported by air in rapidly increasing amounts.

In considering the rental or docking charges previously mentioned, we frequently find that the owners of these terminals in instances where this ownership is vested in a municipality or port authority are engaged in a business designed to make a profit. There is a tendency on the part of these owners or lessors to overlook the fact that the property owned or controlled is in the nature of a quasi public utility which serves not only the operator using this facility, but also the citizens of the entire community in which these

facilities are located. In a city such as New York, it has been estimated that over one million people have a direct interest in the commerce and industry of the port. Several more millions of citizens in the area surrounding the Port of New York are, of course, indirectly benefited by their proximity to nature's gift of the port. On the principles of supply and demand, the rentals of municipally owned terminals, which constitute the bulk of terminal facilities, run into extremely high figures. If we take the view that these properties are in the nature of quasi public properties, justice demands that owning the properties should be on a non-profit basis. A further consideration would be that the public which benefits by these facilities has a legitimate share in the cost of maintaining and operating these properties.

Labour Picture

With respect to the elements of cost which have been augmented by the labour picture as outlined, the time has come when industry and labour must sit down and come to the joint realisation that many of the conditions experienced have yielded increased costs in marine transportation which approach the breaking point. The realisation that sporadic wildcat work stoppages form a particularly thorny problem has been reached.

Standard contract provisions for arbitrating disputes which frequently lead to wildcat work stoppages are in many instances of ancient vintage. These provisions have all too frequently been found to lack a formula preventing sporadic work stoppages. Both industry and organised labour have come to realise their responsibility to the public and are rapidly approaching the time when either a joint industry labour board or a labour tsar will be created in collective bargaining agreements and an adequate sanction will be recognised to guarantee an uninterrupted flow of work pending the settlement of any dispute.

It is apparent that no matter how complete a contract may be in the first instance covering working conditions, premium pay clauses and other rights and obligations of industry and labour under a contract, disputes will arise. The important thing is for industry and labour to settle on some form of immediate solution of these disputes without temporary cessation of work.

We mentioned briefly some of the so-called rackets which lead to increased costs. Individuals who participate in most of these activities are, of course, guilty of a crime. When this fact is considered, it would appear that the problem is a police problem. Some strides have been made in coping with these problems by the encouragement of police effort, with the co-operation of management and organised labour.

Despite the good work being done by augmented police activity in many ports and by private enterprise, I believe that the fundamental solution lies in a programme of understanding and cooperation. Labour must realise that the employers who use the services of men engaged in the hard work of terminal cargo handling are operating in a highly competitive field. Each employer in any given trade-run is competing with others engaged in the same service. Each employer accordingly has a great desire to run its terminal operation as efficiently as possible. I believe that the unchallenged right of an employer to discipline employees for adequate cause, with the consequent placing of a man's job at stake, constitutes the greatest deterrent against the so-called rackets.

Oil Pollution Research.

The 134-ton yacht Gay Caprice, which was chartered in July by Anglo-Iranian Oil Co., Ltd., in co-operation with Shell and the Esso Transportation Company, left Falmouth four times in the past three months to follow floating oil patches discharged 50 to 100 miles out at sea.

The Government observers, scientists and tanker masters on board followed the oil, studying its rate of flow, its resistance to the sea and its tendency to coagulate, disintegrate, or sink. The data they obtained are now being studied and will shortly be made fully available to the committee recently constituted by the Minister of Transport to consider what practical steps can be taken to prevent pollution by oil in the waters around the United Kingdom.

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Manufacturers' Announcements

New Pneumatic Power Saw

Danarm petrol and electric power chain saws are famous throughout the world for their high operating speed, light weight and general reliability. Now a new saw, powered by a heavy duty Consolidated Pneumatic air-motor has recently been added to the range.

The CP-Danarm Pneumatic Power Saw, as the new model is called, is outstanding for its light weight, which averages only 29 lbs., for its foolproof operation and its cutting speed in all varieties of timber. It has applications wherever air compressors are used, such as in shipyards, mines, railways, dock buildings and other constructional work. It can be used even under water, a specialised application of particular interest to dock and harbour authorities. It is handy and easy to use, and can be operated by one man, and is claimed to be more generally useful and much faster than the usual "two-man" saw.



General Description.—The saw is equipped with a cutter bar and saw chain giving a cutting width of 23-in.; this enables an operator to fell trees up to 46-in diameter, or to cross-cut timber of 23-in. diameter, when working from one side only. An alternative cutter-bar of 16-in. cutting width is available for lighter work, such as lopping branches, etc., or for working in confined spaces. Various accessories are also available, such as a "helper's handle" which can be fitted to the end of the cutter bar to convert the saw to a two-man machine if desired. A "felling dog" may be attached to the saw, thus enabling the work of tree felling to be done with greater ease by the one man.

The saw is powered by a heavy-duty vane-type "Consolidated Pneumatic" air motor designed for 80/100 lb. per square inch airline pressure, and developing 3 h.p. at 6,000 r.p.m. The air consumption is approximately 50 c.f.m. at 80 lb. pressure per sq. inch.

Tensioning is done at the sprocket by a simple screw adjustment to ensure that the saw chain shall be neither too tight nor too loose.

The cutting chain is made of special heat treated steel of new 3-link design with straight cutters which have a very long life and give a much increased cutting speed over other designs. Each tooth is easily accessible for re-sharpening.

The tubular handle grip at the front of the aw is used as an oil reservoir. Air under pressure to this reservoir forces oil on the aw chain and ensures constant lubrication. The flow of oil is controlled by a needle talve in the lubricating circuit. A small

hand pump is also provided to clean the oil-ways if necessary.

Auckland Harbour Bridge

Contract Awarded to British Firms

The Auckland Harbour Bridge Authority, New Zealand, has accepted the joint tender of two British firms-The Cleveland Bridge & Engineering Co., Ltd., of Darlington, and Dorman, Long & Co., Ltd., of Middlesbrough-for the construction of a new road bridge at Auckland. This was the only British tender submitted and had to meet strong foreign competition, particularly from Continental bridge-builders. The value of the contract is £4,236,000. Each of the firms will fabricate approximately half of the steelwork and will work in association on the construction of the foundations and erection of the superstructure. The weight of steel in the bridge is approximately 10,000 tons. it is anticipated that the bulk of this will be rolled in Dorman Long Mills:

The bridge will satisfy an urgent need in Auckland and has been under consideration for many years. Traffic across the harbour is at present carried by ferries and delay and congestion are severe.

The contract will necessitate sending a large number of skilled men from this country to New Zealand where they will be housed in a camp adjacent to the site.

The overall length of the bridge works which link the City of Auckland with the Borough of Northcote is 3,520-ft. and includes an 800-ft. span over the navigation channel, and six other spans. Designed in high tensile steel of standard structural quality, the bridge superstructure consists of a series of cantilever truss spans. The navigation span and the two adjacent spans are linked together and connected to the North anchorage. At the third pier there is an expansion joint in the structure and from there to the South shore the four tapering approach spans are similarly linked by pinioints and connected to the South anchorage. The navigation span gives a maximum clearance above high water of 142-ft.



Map showing position of new bridge

support footways of reinforced concrete construction. Service ducts covered by removable pre-cast concrete stabs, sealed and paved with asphalt are provided under the tootways.

The piers will be founded on the mudstone rock of the harbour bed and all foundations constructed under compressed air. Due to the great depth of water, air pressure up to 50 lbs. per square inch, the maximum pressure at which such work can be carried on, will be necessary.

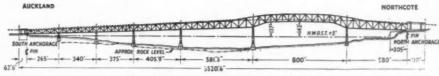
Considerable longitudinal movements of the bridge, caused by variations of temperature and loading, are accommodated by deep rocker bearings within the upper sections of the piers.

Approximately four years will be required for the completion of the structure.

The consulting engineers are Messrs. Freeman, Fox & Partners of London.

The contractors are the largest bridge builders in England, having constructed most of the major bridges of recent years in this country and many notable structures abroad.

The Cleveland Bridge Company built the Victoria Falls Bridge, Rhodesia, the Lower Zambesi Bridge, Portuguese East Africa, and the New Howrah Bridge, Calcutta, and at present are constructing two bridges in New South Wales. In the United Kingdom, they were responsible for the King Edward VII Bridge, Newcastle, and the Kincardine-on-Forth Bridge, and have under construction at present the Neath By-Pass Bridge and Viaduct for the Ministry of Transport.



Elevation of new Auckland Harbour Bridge.

The piers have been designed to resist earthquate shocks and are of hollow reinforced concrete construction.

A roadway 55-ft. wide and two 6-ft. wide footways are provided and the bridge will also carry water, gas and electric services. The roadway deck consists of a reinforced concrete slab supported by welded steel stringers, whose too flanges are bonded to the slab. The wearing surface is formed by a carpet as asphalt. Welded steel stringers

Dorman Long & Company built the Sydney Harbour Bridge, several structures across the Nile, the Otto Beit Bridge, Rhodesia, Storstrom Bridge, Denmark (the longest bridge in Europe) and since the war the Kafr-el-Zayat Bridge, Egypt, the Vila Franca Bridge, Portugal, several bridges in Iceland, and also the New Tyne Bridge, Tees Newport Bridge, Lambeth Bridge, London, and many other structures of various types.

Manufacturers' Announcements_continued

Diesel Locomotive for Port of Callao

A six-wheel 52-ton development of the eight-wheel 55-ton locomotive tested last year on British Railways has just been snipped to Peru by the Hunslet Engine Co., Ltd., for heavy shunting in the dock area at Callao, and for running into warehouses and private sidings. It will also be available for any work of a similar nature on the Central Railway of Peru in the Callao and Lima districts.

Owing to the sharp curves of the harbour and warehouse lines, the wheelbase has been limited to only 9-ft., and flangeless centre tyres have been provided to enable standard-gauge curves of 160-ft. radius to be traversed. Also, as there are no limiting under-line structures, the weight concentration of 5\frac{3}{4} tons per foot of wheelbase does not restrict the route availability. Maximum axle load is 17.4 tons.

The power and transmission equipments are the same as those of the o-8-o locomotives built last year, and comprise a Paxman Vee engine of 500 b.h.p. at 1,375 r.p.m. and a Hunslet six-speed gearbox arranged to give a top track speed of 33 m.p.h. Maximum tractive effort on bottom gear step is 35,000 lb. Jackshaft drive with resilient wheels, and then rods, transmit the drive to the wheels. Hauling capacity is up to 1,400/1,500 tons round dock lines.

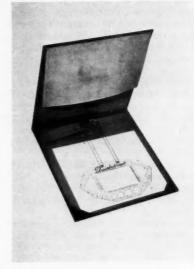
African Contract

Braithwaite and Co., Engineers, Ltd., of Great Bookham, Surrey, have been awarded two important contracts on the African continent, both of which involve port extension works, based on the use of the "Screwcrete" system of piling, which is a speciality of the firm. One of the contracts is in the Port of Tiko in the British Cameroons, where a new jetty is to be constructed for the Cameroons Development Corporation. The second and larger contract is in the Port of Mombasa, Kenya, and involves the construction of new wharves at

Kilindini for East African Railways and Harbours. It is estimated the cost of the two contracts will total about £2,000,000.

New Drawing Instrument

The "Quickdraw" is an ingenious device which provides an invaluable aid to the production of outline drawings, plans and sketches, rapidly and accurately to scale. As will be seen from the accompanying illustration, it consists of a transparent template, cut with mathematical accuracy to produce the



principal angles, also triangles and rectangles, either in inches or millimeters to scale. It will also produce circles from $\frac{1}{3}$ to 1-in. in diameter, or sections thereof. There is also a set of nine pencil point holes whereby, with the aid of a ruler, hatching can be neatly and quickly undertaken.

The template is fastened to a toggle hinge by strong metal eyelets, which prevent any possible slackness or sideplay, forming a pantograph, and the whole is securely fixed to the base of the folder, which is 14-in. square and covered in strong rexine leather cloth. The base is 5/16th-in. thick and serves as a drawing board. Corners are provided to hold the paper in position and only one drawing pin in required to hold paper rigid. The lid of the folder is fitted with a pocket to hold spare paper, sketches, etc. The maximum paper size is 10-in. x 13-in.

Drawings can be made with ease, and a wide range of work can be carried out without the need of any additional instruments whatever. Further particulars can be obtained from the "Quickdraw" Company, 127, Gunnersbury Avenue, London, W.3.

Stress Finder for Ship's Loading

A Stress Finder, manufactured by Kelvin and Hughes (Marine), Ltd., of 99, Fenchurch Street, London, was marketed recently. It is a manually operated mechanical device which computes in advance the effects of loading a ship to any proposed plan. The instrument is simple to work, and entails no mathematical aptitude on the part of the operator beyond that required for elementary problems of addition and subtraction.

Details of the proposed loading plan are fed into the instrument by means of two pointers and circular scales, one each for the cargo spaces forward and aft of amidships. A deadweight scale, operated by a separate control, is also provided.

Computation is automatic and takes place progressively as the loading and deadweight controls are moved. At the conclusion of the operation, which takes but a few minutes, a longitudinal scale is consulted. This indicates clearly whether the vessel will be subjected to undue hogging or sagging stresses when loaded to the proposed plan. The same scale indicates draught and trim in the proposed loaded condition.

The instrument is robustly constructed of metal and when housed in its polished wooden case, the complete outfit can be carried around as easily as a sextant.

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FOR SALE.

DREDGING AND RECLAMATION PIPES.

Approximately 171 mild steel electrically welded pipes, 24-in, bore and 4-in, thick x 20-ft, long. Flat flanges for bolted connection welded on each end. Condition, unused and slightly used. For further information write Box No. 144, "The Dock & Harbour Authority," 19, Harcourt Street, London, W.1.

DRAGON HEAT MACHINES, the quickest and most effective means of removing barnacles and other seagrowth from shipping. Used extensively for burning off tar and rust, etc. Can be adapted to make a Portable Forge for heating metal and liquids or as a "Booster" in boilers to attain desired temperatures in a matter of minutes. Two hours continuous burning from two galls, of paraffin. An inexpensive heat machine. £15 15s. 0d. each. Write for details to Morton Longley Limited, 260, The Beacon, Hillingdon, Middx.

PUBLIC APPOINTMENTS.

CIVIL ENGINEERING CONTRACTORS with office near London require qualified Engineer to supervise various contracts in South and Midlands embracing shuttering, reinforced concrete, piling, deep excavations, factory construction, sewerage and harbour works. Knowledge of modern plant, unit costing, bonus scheme and office administration necessary. Applicant should be competent to negotiate with consultants and Local Authority Engineers. The proposed salary, including bonus, will be from £1,800-£2,200 per annum, depending on ability and subject to revision later. Car supplied with expenses, also Pension Scheme in operation. Apply: Box No. 145, "The Dock & Harbour Authority," 19, Harcourt Street, London, W.1.

TYNE IMPROVEMENT COMMISSION.

The Tyne Improvement Commissioners are undertaking major port development schemes and invite applications from Civil Engineers for appointment to their Technical Staff in connection with the design, construction and maintenance of Dock and Harbour works.

commencing salaries will be in accordance with the qualifications and experience of the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the range of £462 to £741 per appropriate the successful candidates and within the successful candidates and

4741 per annum, plus a war bonus of £65 per annum.

Applicants should be experienced in design and the preparation of estimates, contract documents and drawings for reinforced concrete and steel structures, retaining walls, under water foundations, small industrial buildings, water supply, etc., and should preferably have a University degree in Engineering and/or be Corporate or Student member of the Institution of Civil Engineers.

Successful applicants will be required to pass a medical examination and to become members of the Tyne Commission Superannuation Fund.

Applications stating age. qualifications and experience, together with copies of recent testimonials, should reach the undersigned not later than the 29th November, 1952.

Tyne Improvement Commission,

J. K. McKENDRICK,

yne Improvement Commission, Bewick Street, Newcastle-upon-Tyne, 1. J. K. McKENDRICK, Secretary. 28:h October, 1952.

ADMIRALTY.—Vacancies exist for Civil Engineers (Main Grade) in the Civil Engineer-in-Chief's Department, Pinner, Middlesex. Starting salary £950 per annum. Duties cover Headquarters Administration of Civil Engineering programme. Temporary appointments. Minimum age 40 Applicants must be natural born British subjects and corporate members of the Institution of Civil Engineers. Administration experience essential Application forms quoting E149/52/A from Ministry of Labour and National Service, Technical and Scientific Register (K), Almack House. 26, King Street, London, S.W.1.